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MAR 28 1922

AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol. XLVI
Number 12

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MARCH 23, 1922

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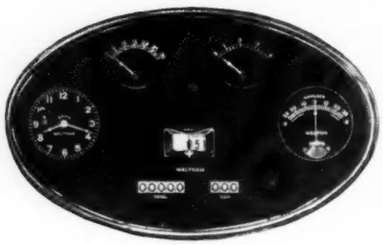

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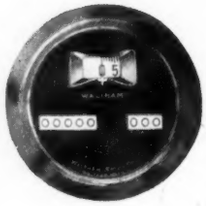

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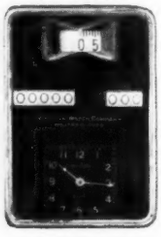

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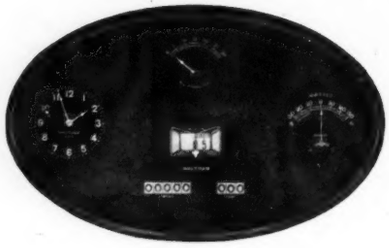

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Keen Sales Competition in Middle Priced Car Field

46 per cent of all car manufacturers are competing for the 18 per cent of total car business comprised in the middle priced market. This article analyzes the $1000-$2000 car market, and presents statistics and methods of value to passenger car manufacturers.

By Norman G. Shidle

Charts and Statistics by Raymond B. Prescott

THE market for cars selling between $1,000 and $2,000 calls for special analysis, since it presents the field of keenest competition in the automotive industry. Manufacturers building cars in this middle-price group need, perhaps more than any others, detailed data upon which to plan production and sales effort.

In 1921 there were 85 N. A. C. C. members producing passenger cars, and of this total 33 were making cars in the middle-price group; 1921 passenger car production totaled 1,457,000. Of this total 291,432 consisted of middle-price class production. In other words, 39 per cent of the car manufacturers were competing for 20 per cent of the business.

The 1922 production figures, as predicted by AUTOMOTIVE INDUSTRIES, indicate that about 306,000 cars, or 18 per cent of the total 1922 production, will consist of cars in the $1,000-$2,000 class. But a survey of the N. A. C. C. membership lists shows that 46 per cent of the total car manufacturers in the field this year are competing for this 18 per cent of the probable total business.

The chart in Fig. 1 shows the relation of production in the middle-price group to total car production for the years 1912 to 1921 inclusive, the figures for 1922 being predicted. A study of these curves indicates that the proportion of cars in this group as related to total car production has not varied widely from year to year, although the "high spending" years of 1919 and 1920 reacted to the benefit of the middle-price group at the expense of the "under $1,000 group." These years were clearly abnormal, however, both for the automotive industry as a whole and for the middle-price group.

The manufacturer in this price group is interested in two sets of data:

1. The status and probable development of the price group as a whole.
2. The relation of his individual company to the group development.

Viewing the figures for this group over the period indicated, a tendency toward a relative decrease appears. That is, the percentage of cars in this group, as compared with the total car production, shows no indication of growing any larger, the tendency being rather in the opposite direction. This relation, of

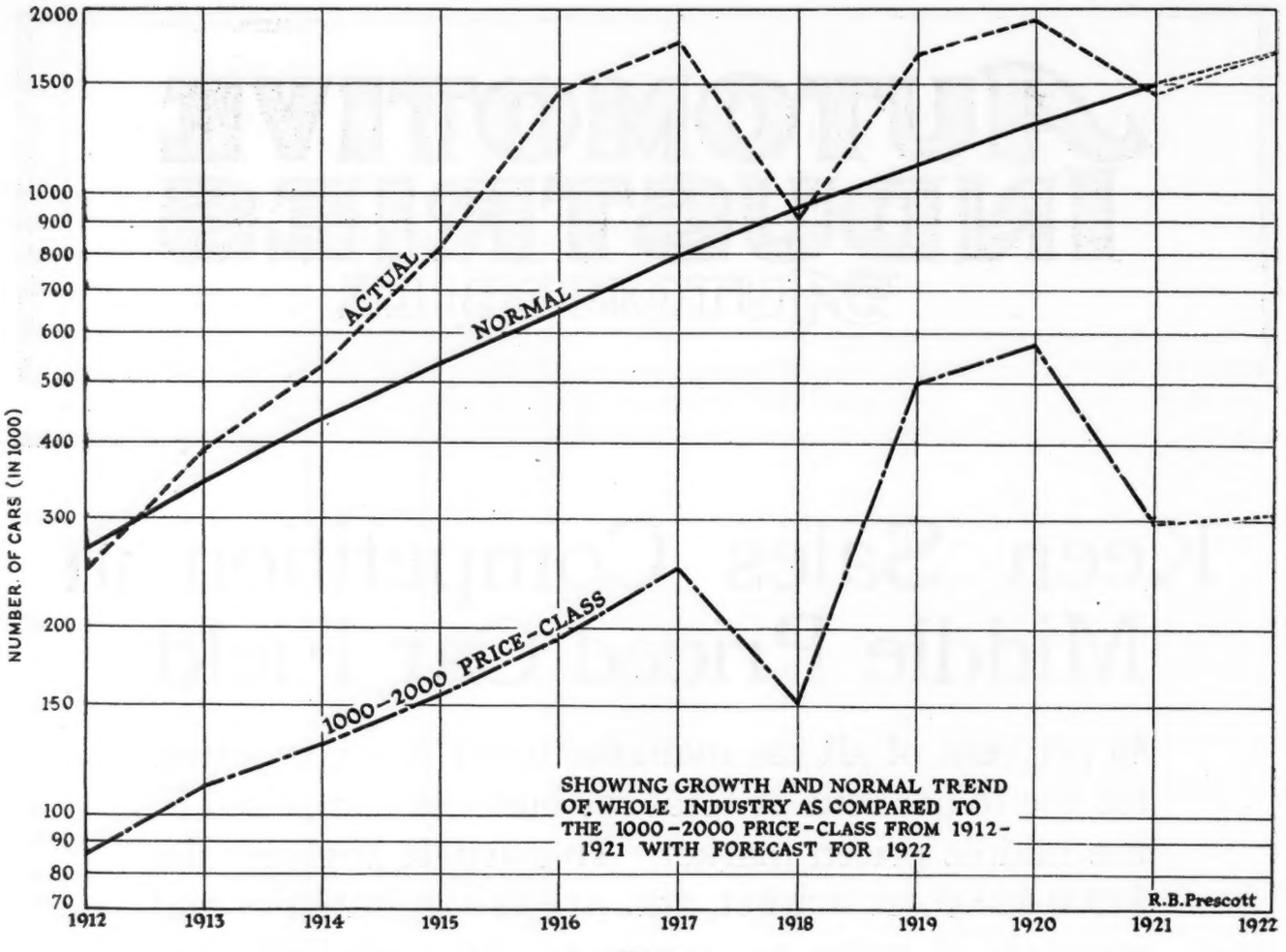

Fig. 1

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A summary of the period 1912-1921 shows that 11,162,000 cars were produced, of which number 2,463,000, or about 22 per cent, were in the $1,000-$2,000 price class.

The tendency of middle-price production to decrease slightly in proportion to total production is particularly interesting, in view of the relative increase in the number of manufacturers making cars in this class. The curve in Fig. 2 shows this relation clearly.

It might be expected that, as the percentage of the total production comprised by this group dropped, the number of manufacturers in the group would drop also. As a matter of fact, just the opposite has occurred.

As the middle-price class percentage of total production dropped, the number of manufacturers entering the group increased. This was true during the period 1912 to 1916, during which the percentage steadily dropped. And the figures available for 1922 indicate a similar tendency at the present time.

This trend indicates a distinct increase in the competitive conditions of the middle-price class market at times when the potential market possibilities of the class are on the decline as compared with the total market. It indicates, as well, that those manufacturers who remained in the price group during the period when the percentage of business was increasing benefited in getting a stronger hold on the particular market.

This latter trend is illustrated by an analysis of the 1921 figures for this price group. These figures show that, in 1921, 33 manufacturers in the middle-price group produced 291,432 cars, but that of this total, 80 per cent of the cars were produced by ten companies. A further examination shows that of these ten companies producing 80 per cent of the middle-price cars, nine of them have been constantly in this price group for five years.

The increase and decrease in middle-price percentage of total car production has been given to or taken from the "under $1,000" group chiefly. In other words, the percentage decrease in the middle-price group from 1912 to 1917 was compensated chiefly by a percentage increase in the "under $1,000" group, while the middle-price group percentage increase in 1918 to 1920 was accompanied by a loss in production percentage in the "under $1,000" group.

The drop in the number of firms in the middle-price group in 1918-1920, on the other hand, occurred chiefly because of the jumping of many firms in the middle-price group to the high-price classes. The following table shows the movement of cars in and out of the middle-price class from 1912-1922:

	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
Total in group.....	20	20	30	39	38	43	40	35	33	34	44
New cars		4	12	2	3	8	3	1	3	5	2
From lower price group ..		0	1	1	0	2	5	4	3	0	0
From higher price group ..		1	1	9	4	0	0	0	0	1	12
Out of business..... ..		4	1	2	1	2	3	2	2	1	1
To lower price group.. ..		0	2	1	5	3	0	1	0	1	3
To higher price group ..		1	1	0	2	0	8	7	6	3	0

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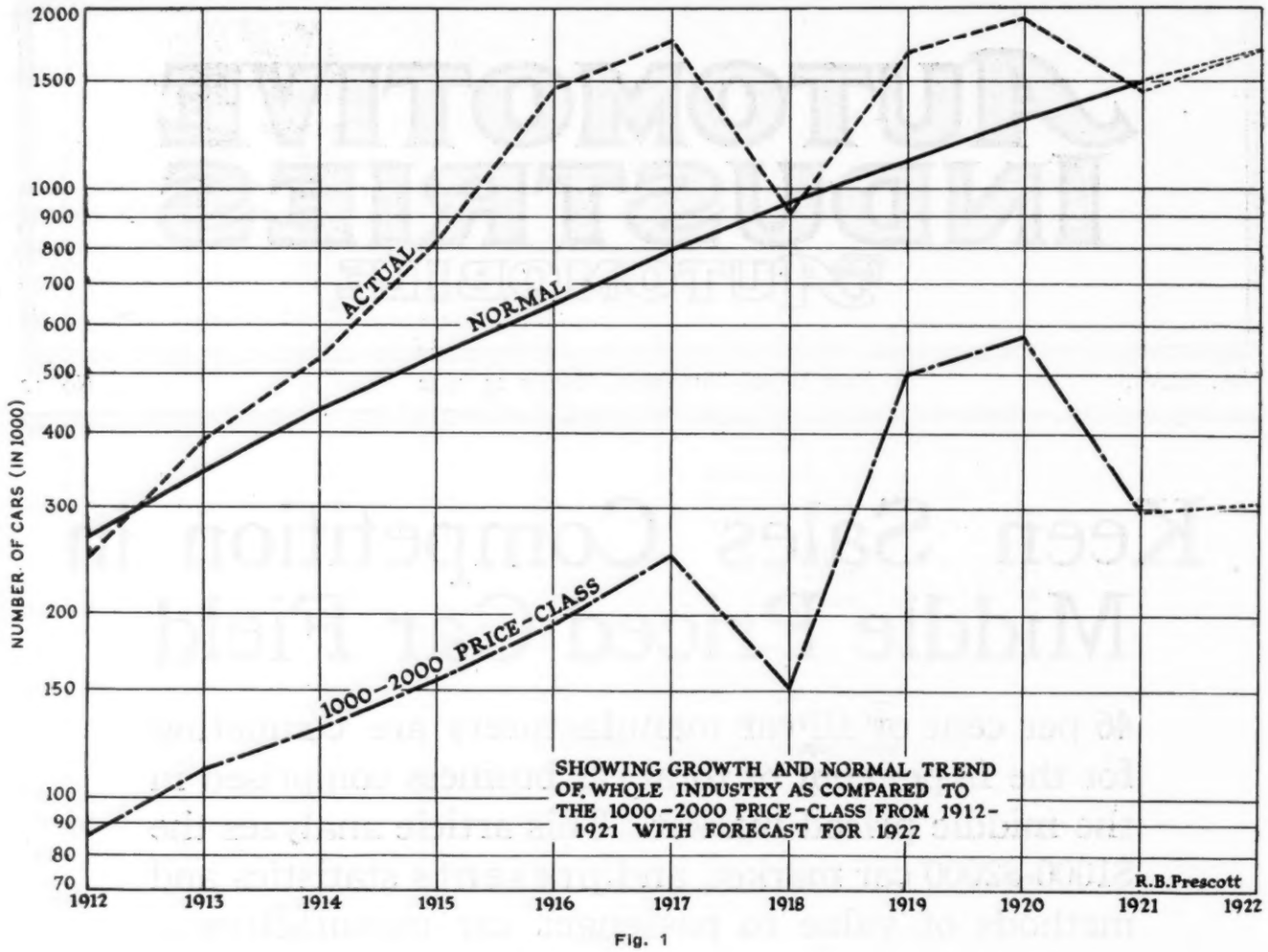

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This average, of course, is for the group as a whole and does not apply to particular firms, some of which will undoubtedly run much nearer to capacity, while some will have to operate at less than half capacity.

This completes the picture of the middle-price class group as a whole. The picture shows a field of intense competition, into which more cars have come during periods in which the field offered decreasing possibilities. It shows about 25 per cent of the companies in the field producing about 80 per cent of the cars, the remaining 75 per cent of the companies competing for 20 per cent of the potential middle-price class market.

Steady profits are related to many factors other than quantity production. It is perfectly possible for a company to continue in a prosperous condition, although its production growth does not keep pace with that of its price class. The trend of individual production curves, however, as related to price class production curves constitute an important part of the market picture necessary in planning production and sales schedules.

Enthusiasm and optimism are essential parts of sales effort, but in buying equipment and materials, sound facts yield greater profits. The production schedule should be based upon what the individual manufacturer can reasonably expect as his proportion of his price class market. This article gives the statistics and methods necessary to a determination of that proportion.

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In considering the market possibilities for his particular car, the individual manufacturer must utilize, not only the statistical data presented, but also the principles upon which that data is built up. Experience shows, for instance, that a given company can scarcely expect to make radical changes in its trend of sales curve within a single year. Human nature is such that habit and inertia play a large part in buying and also in organization methods and ideas. Much progress can be expected within a single year or two, but radical changes cannot. A manufacturer can well base his plans for the coming years upon the trend of his sales curve in past years as related to the sales curve of his price group. It is this fact that makes the accompanying statistical data of value; that makes it possible to draw a sound, normal curve for the industry, and to predict with considerable accuracy the production and registration figures of the industry for two to five years in advance.

It is worth while to emphasize here again the necessity for those using these figures in planning to be familiar with the data that has gone before and the basis upon which that data was built up. The two previous articles appeared in AUTOMOTIVE INDUSTRIES of Nov. 17 and Dec. 22, 1921, respectively.

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Fig. 3 shows the relation of six typical middle-price class cars to the progress of their price group. The cars chosen for this illustrative analysis have all remained in the middle-price class group throughout the period charted. Two of them are so-called assembled cars, while the other four are built up almost entirely within the manufacturer's own factory. An analysis of the chart brings out some interesting points.

Car A, for example, has had the largest production and has followed very closely the production trend of the entire price class. So striking is the similarity between A's curve and the price-class curve that A may be said to be a signpost to the probable trend of the entire group. The curve indicates that Company A has consistently maintained its relative position in respect to the price group of which it is a part, and that its production for the coming year will probably be about the same in relation to its past production as will be the total group production in relation to the past group total. In other words, a company with a production curve similar to that of Company A can plan its production schedule with reasonable certainty on the assumption that it will at least maintain its relative position in its price group. The proportion might be stated in this way:

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In most cases, however, the analysis is not quite so simple. Factors enter into consideration that cannot be accounted for purely on the basis of price-class market. The new car entering the field must take time to establish itself; change in policy and management may occur, necessitating temporary slowing up in production or readjustment in sales policy; internal financial battles may be waged with a consequent effect upon public opinion and sales. All such factors must be considered by the individual manufacturer in making his analysis.

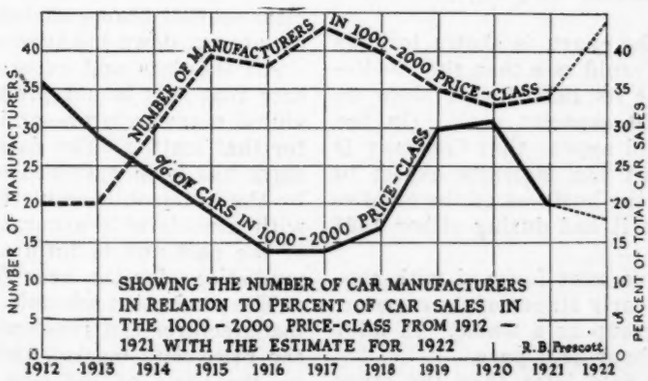

Fig. 2

The production of Company B shows a somewhat different picture. This company made more rapid progress than its price group from 1912 to 1916, but since that time has not kept pace. It is worth while to note here, however, that a company may continue to be prosperous without keeping pace with the

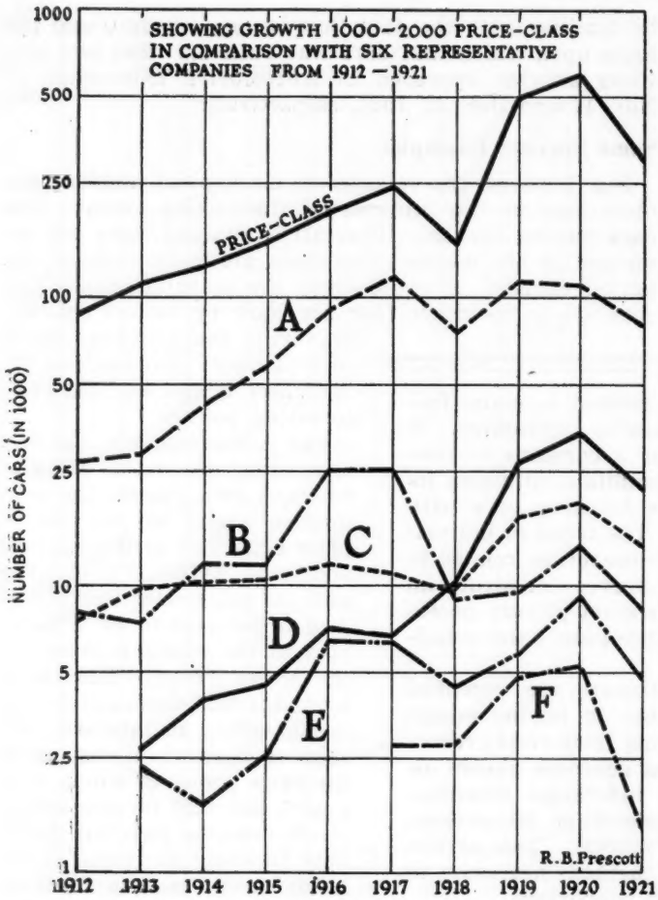

Fig. 3

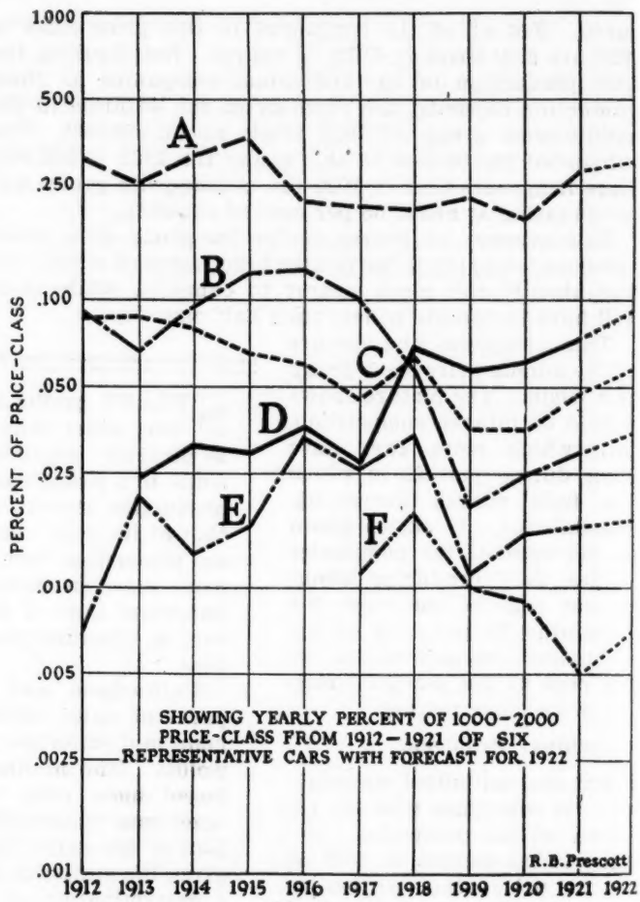

Fig. 4

growth of its price group. Steady profits are related to many factors other than quantity production.

In the case of Company B, however, there would appear to be a production capacity in 1922 of some 16,800 in excess of actual production, thus indicating the necessity of either reducing the production capacity or obtaining a greater share of the price-class market that production may be increased. The trend of Company B's curve during the last five years does not indicate that there is a likelihood that Company B will be able to obtain that larger proportion of the market during the next year or two.

The curve for Company C shows a different condition again. Clearly, through the period charted, this company has failed to increase its production in proportion to the general increase of the price class. On the other hand, taking 1920 as its production capacity, there is not a large discrepancy, comparatively speaking, between its actual 1921 production and its production capacity.

Company D, according to the chart, is shown to have gained consistently at a more rapid rate than the middle-price group as a whole, while its 1921 figures show no abnormal drop from the 1920 capacity peak. On the basis of these records it would appear that Company D is the only one plotted which can logically expect to obtain a larger proportion of the business of the middle-price group during 1922 than it had during either 1921 or 1920.

Company E is shown to have gone forward with considerable rapidity during the early stages of its career—more rapidly than its price group as a whole. In later years, however, it has just about kept pace.

Company F came into the field later than the other companies charted. As might be expected, during its period of growth it did not progress as rapidly as the group as a whole. It felt the effects of the business depression more heavily than did the companies more firmly established in the minds of the public, as is shown by the relatively sharp drop in 1921 production.

Fig. 4 shows the percentage of the total business of the price class obtained each year by these six typical companies. It gives in actual figures the general trend outlined.

Production and sales plans must be made upon the basis of real analysis and accurate data if permanent progress is to be made. In fact, such analysis is necessary if a company is to stay in business under present competitive conditions. Enthusiasm and optimism are essential parts of sales effort, but in buying equipment and materials sound facts yield greater profits.

It is human nature for every individual maker to feel that by more intensive sales methods he may be able to obtain this year a considerably larger share of his price-class market than ever before, and thus produce enough cars to cut down his overhead expense.

All the data and experience available, however, indicate that this is not probable in the case of any individual manufacturer—or in the case of any price class, for that matter. The data given by AUTOMOTIVE INDUSTRIES has been gathered over the entire period covered by the automobile industry, and can be said to picture with considerable accuracy the lessons and experience of the past and to form a basis upon which intelligent predictions for the near future can be made.

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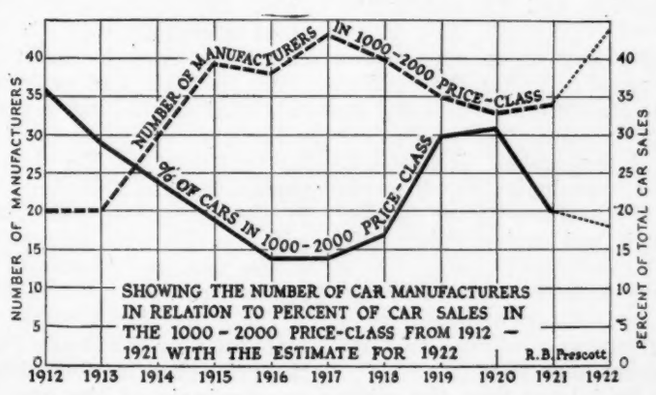

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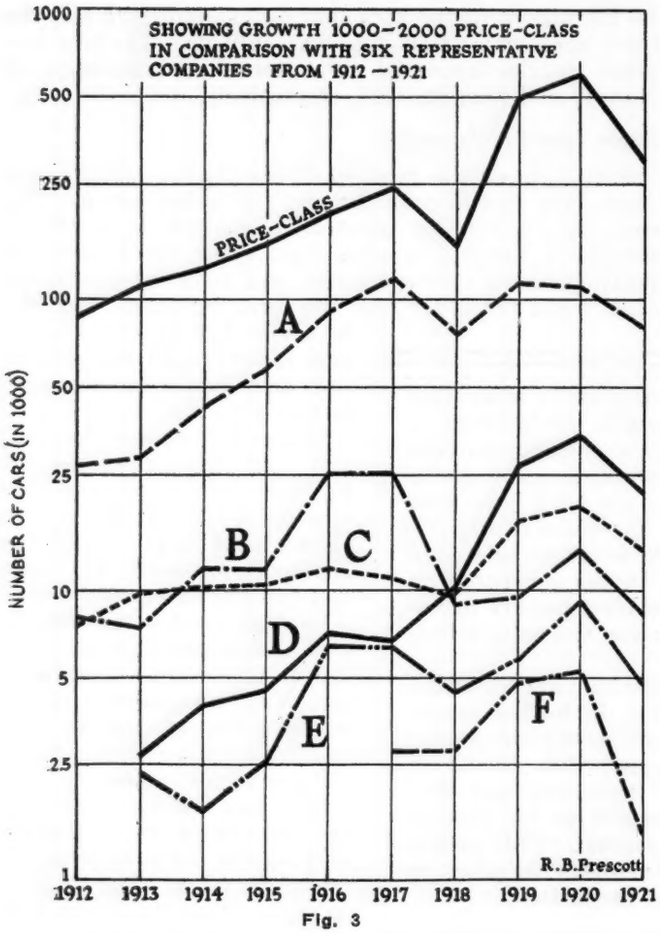


Fig. 3

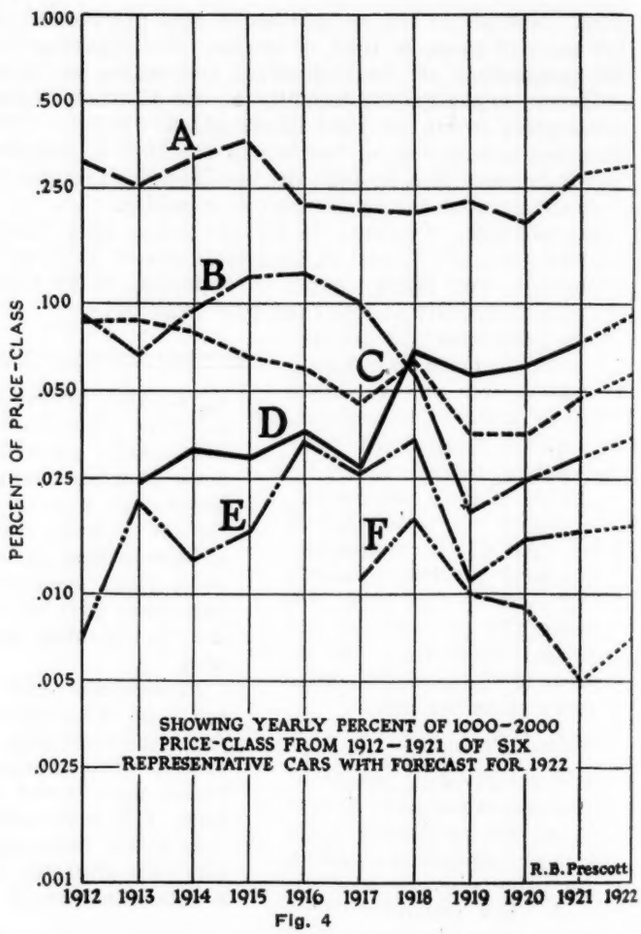


Fig. 4

growth of its price group. Steady profits are related to many factors other than quantity production.

In the case of Company B, however, there would appear to be a production capacity in 1922 of some 16,800 in excess of actual production, thus indicating the necessity of either reducing the production capacity or obtaining a greater share of the price-class market that production may be increased. The trend of Company B's curve during the last five years does not indicate that there is a likelihood that Company B will be able to obtain that larger proportion of the market during the next year or two.

The curve for Company C shows a different condition again. Clearly, through the period charted, this company has failed to increase its production in proportion to the general increase of the price class. On the other hand, taking 1920 as its production capacity, there is not a large discrepancy, comparatively speaking, between its actual 1921 production and its production capacity.

Company D, according to the chart, is shown to have gained consistently at a more rapid rate than the middle-price group as a whole, while its 1921 figures show no abnormal drop from the 1920 capacity peak. On the basis of these records it would appear that Company D is the only one plotted which can logically expect to obtain a larger proportion of the business of the middle-price group during 1922 than it had during either 1921 or 1920.

Company E is shown to have gone forward with considerable rapidity during the early stages of its career—more rapidly than its price group as a whole. In later years, however, it has just about kept pace.

Company F came into the field later than the other companies charted. As might be expected, during its period of growth it did not progress as rapidly as the group as a whole. It felt the effects of the business depression more heavily than did the companies more firmly established in the minds of the public, as is shown by the relatively sharp drop in 1921 production.

Fig. 4 shows the percentage of the total business of the price class obtained each year by these six typical companies. It gives in actual figures the general trend outlined.

Production and sales plans must be made upon the basis of real analysis and accurate data if permanent progress is to be made. In fact, such analysis is necessary if a company is to stay in business under present competitive conditions. Enthusiasm and optimism are essential parts of sales effort, but in buying equipment and materials sound facts yield greater profits.

It is human nature for every individual maker to feel that by more intensive sales methods he may be able to obtain this year a considerably larger share of his price-class market than ever before, and thus produce enough cars to cut down his overhead expense.

All the data and experience available, however, indicate that this is not probable in the case of any individual manufacturer—or in the case of any price class, for that matter. The data given by AUTOMOTIVE INDUSTRIES has been gathered over the entire period covered by the automobile industry, and can be said to picture with considerable accuracy the lessons and experience of the past and to form a basis upon which intelligent predictions for the near future can be made.

The production schedule should be based upon what the manufacturer can reasonably expect as his proportion of the price-class market, this proportion to be determined on the basis of the best available statistical data and financial situation of the individual company.

International Brings Out Advanced Design of Tractor

Employs one-piece frame, but maintains unusual degree of accessibility. Engine has two-bearing crankshaft, removable cylinder liners and overhead valves, all wearing parts being easily replaceable. Double reduction by bevel and spur gears to live rear axle. All gears run in bath of oil.

By Herbert Chase

ONE of the most interesting and advanced designs of farm tractor which has recently come to our notice is that developed by the International Harvester Co., which is to be known as the 15-30 gear drive model. This machine embodies many of the features of the most progressive designs which have appeared of late, and goes a step further than these in some directions.

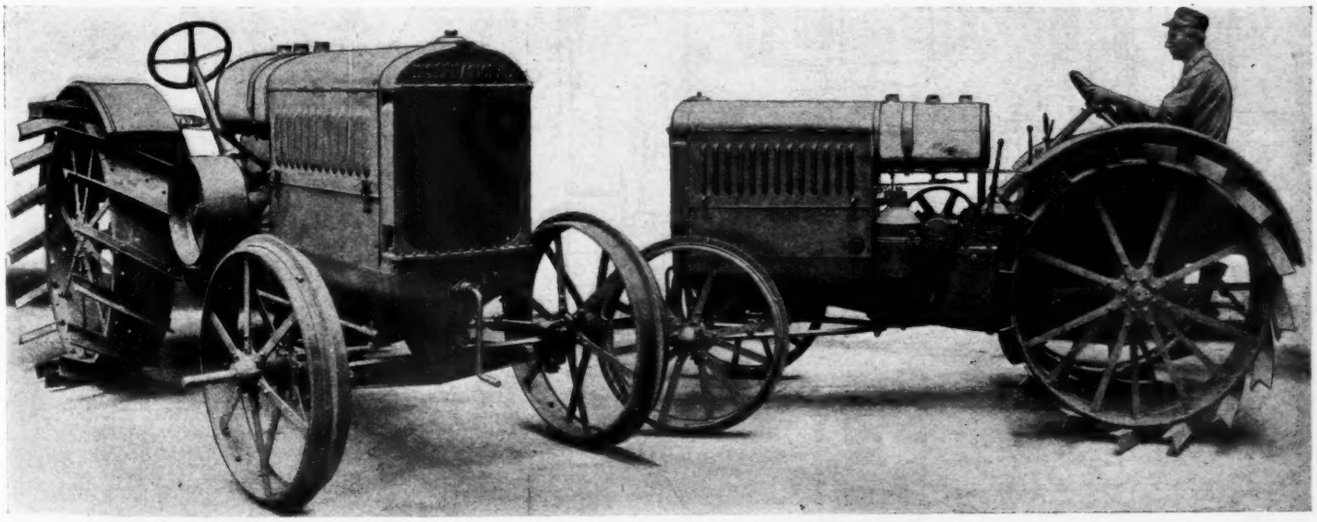
The new product is of the one-piece cast frame type, and has a live rear axle and an automobile type front axle with single support at its center. One of the objects which the designers have sought to attain is an unusual degree of accessibility. The chief disadvantages of some machines with a one-piece frame is the fact that it has been rather difficult to dismantle them or reach various parts when repairs are required. In this new product, however, most of the units, such as the gearset, the clutch, the axle gears and the belt pulley drive, can be readily taken out without disturbing, except in a minor way, adjacent units. Furthermore, the design is such that the various parts can be removed and dismantled with minimum expenditure of time.

The new tractor has a wheelbase of 85 in., rear wheel tread of 50 in., front wheel tread of 46 in. and a turning radius of 15 ft. It weighs 5575 lb. filled, 3325 lb. being on the rear wheels and 2250 lb. on the front wheels.

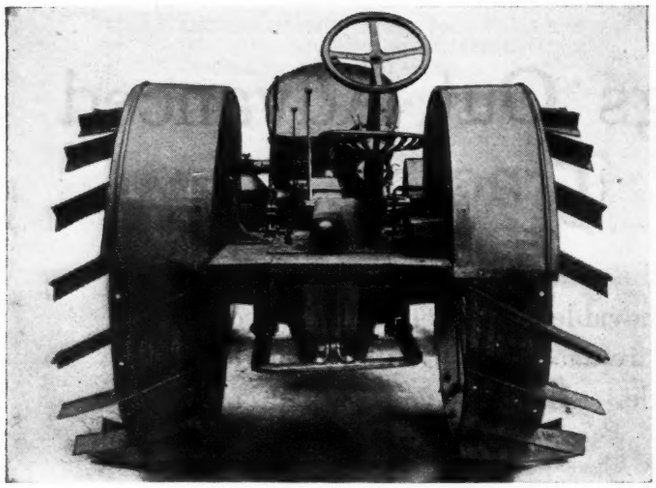
Among the unusual features of this tractor is the use of a two-bearing crankshaft and a main casting which carries the removable cylinder sleeves and includes both upper and lower halves of the crankcase. The crankshaft is supported in two large annular ball bearings. The connecting rods can be inspected by removing hand hole covers at the side of the case and are easily adjusted after removing the crankcase pan. The cylinder head is detachable, and is used to hold the separate cylinder liners in place. Against the latter bear rubber gaskets, which make a water-tight jacket joint. Aside from the features mentioned, the engine is more or less conventional in general design. It has a 4½-in. bore and 6-in. stroke and is governed to run normally at 1000 r.p.m. Overhead valves are employed. They are operated by rocker arms and pushrods from the camshaft in the crankcase. Oil troughs above the rocker arms provide lubrication through wicking. The removable sleeves are machined inside and out, and can be easily replaced when worn or scored, as can all other wearing parts of the engine.

The connecting rod bearings are bronze-backed, babbitt-lined and measure 2⅞ in. diameter by 3 in. long. The crankshaft is heavily constructed to give adequate stiffness. The connecting rods have a conventional H-section and carry a solid bronze piston pin bushing. The pins are 1½ in. in diameter and are locked securely into the pistons. The latter are 5⅞ in. long and equipped with four rings, all located above the piston pin.

Lubrication is by splash, the oil being raised from the sump to the oil pan by a gear pump driven by a vertical



Front and side views of 15-30 gear drive International tractor, showing one-piece frame, pivoted on front axle, wishbone and location of belt pulley and air cleaner



Rear view of new International tractor, showing power take-off on upper axle housing and adjustable drawbar

shaft off the camshaft. An oil gage, located on the dash, enables the operator to determine whether or not the oil is circulating properly.

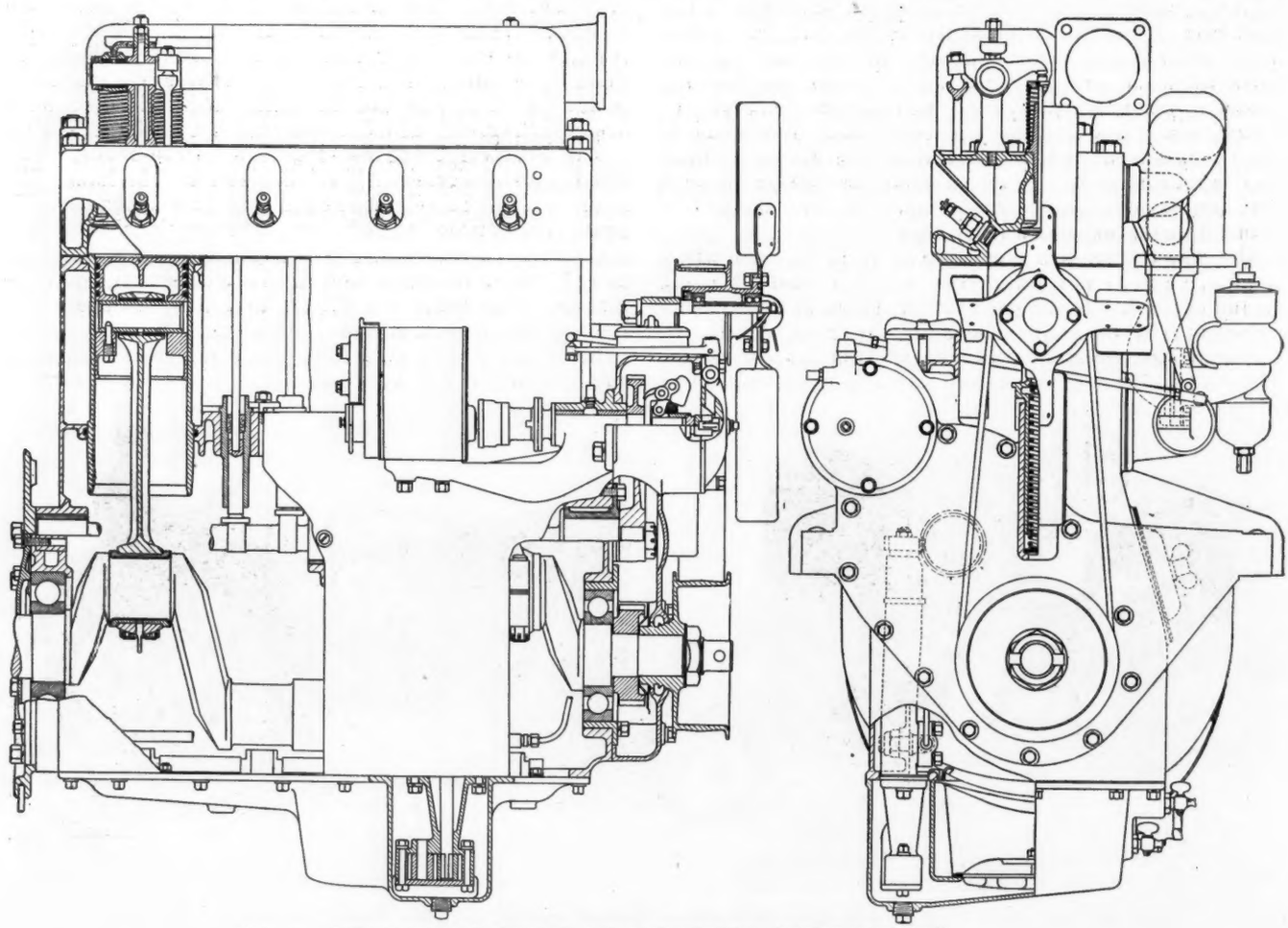
All working parts of the engine are completely inclosed, so that the exterior has a clean appearance. The exhaust manifold at the left side of the engine is bent downward and terminates in a short pipe projecting through the lower edge of the hood. The air cleaner is mounted at the left side of the frame outside and just back of hood. It is connected to an Ensign carbureter which delivers the mixture through a short riser to the exhaust-heated inlet manifold, which is cast in one piece with the exhaust header. This fuel system is designed to handle either gasoline or kerosene, tanks for both being provided. A centrifugal throttling type governor, driven off the magneto shaft, is employed. A high-tension magneto with impulse starter is fitted.

The Clutch and Gearset

The clutch is of the multiple dry disk type, driven by pins bolted to the flywheel flange. The driven member is piloted on a short extension of the crankshaft which carries an annular ball bearing. From this point the drive is taken through a short splined shaft, which is integral with the external half of a semi-flexible joint of the internal-external gear type. An annular throwout bearing is carried in a housing with a friction surface which acts as a clutch brake. There are six driving and five driven disks. The design of the clutch is so worked out as to permit of its removal without disturbing either the engine or the gearset.

Directly back of the clutch and driven through the semi-flexible joint referred to is the gearset, mounted in a removable carrier which seats in the main frame casting. This gearset is similar in general construction to that used in automobile practice, the speed changes being accomplished by sliding gears on a splined countershaft. The shafts are mounted on hardened roller bearings, which, in common with similar roller bearings used in other locations, are the product of the International Harvester Corp. Where bevel gears are employed, ball thrust bearings are used.

The belt pulley assembly is a separate unit, mounted in a separate and easily disconnected housing on top of the main frame casting and driven by bevel gears



Part sectional views of engine, showing two-bearing crankshaft

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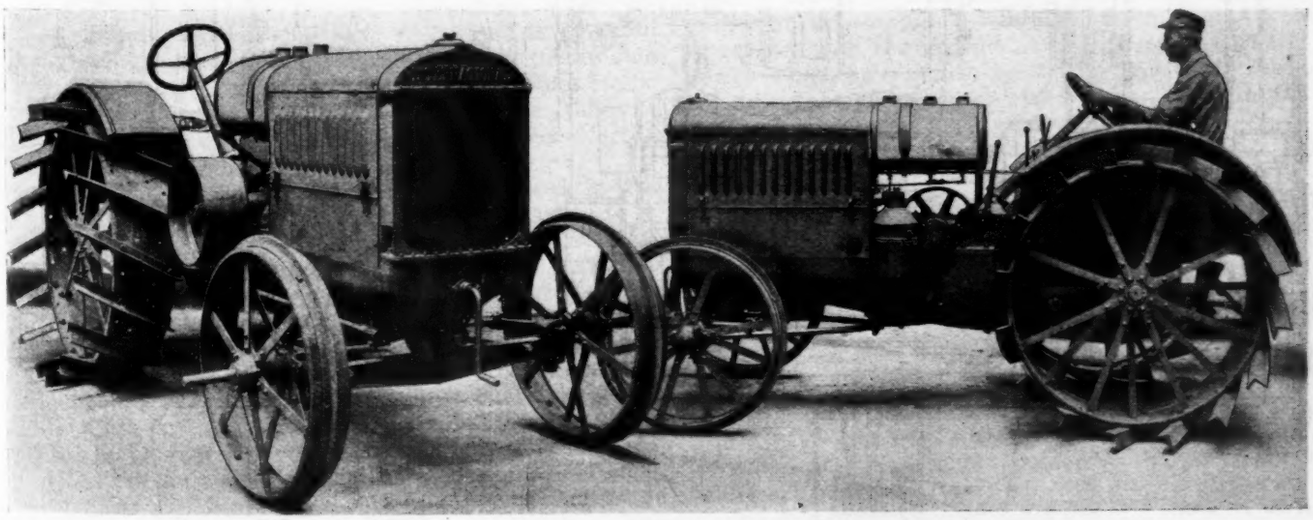

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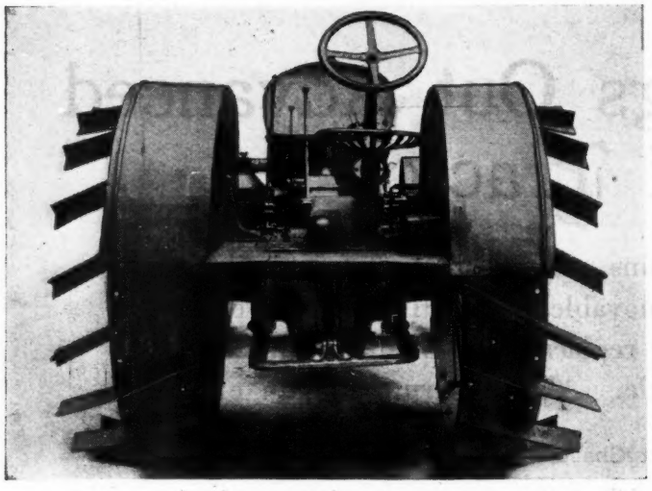

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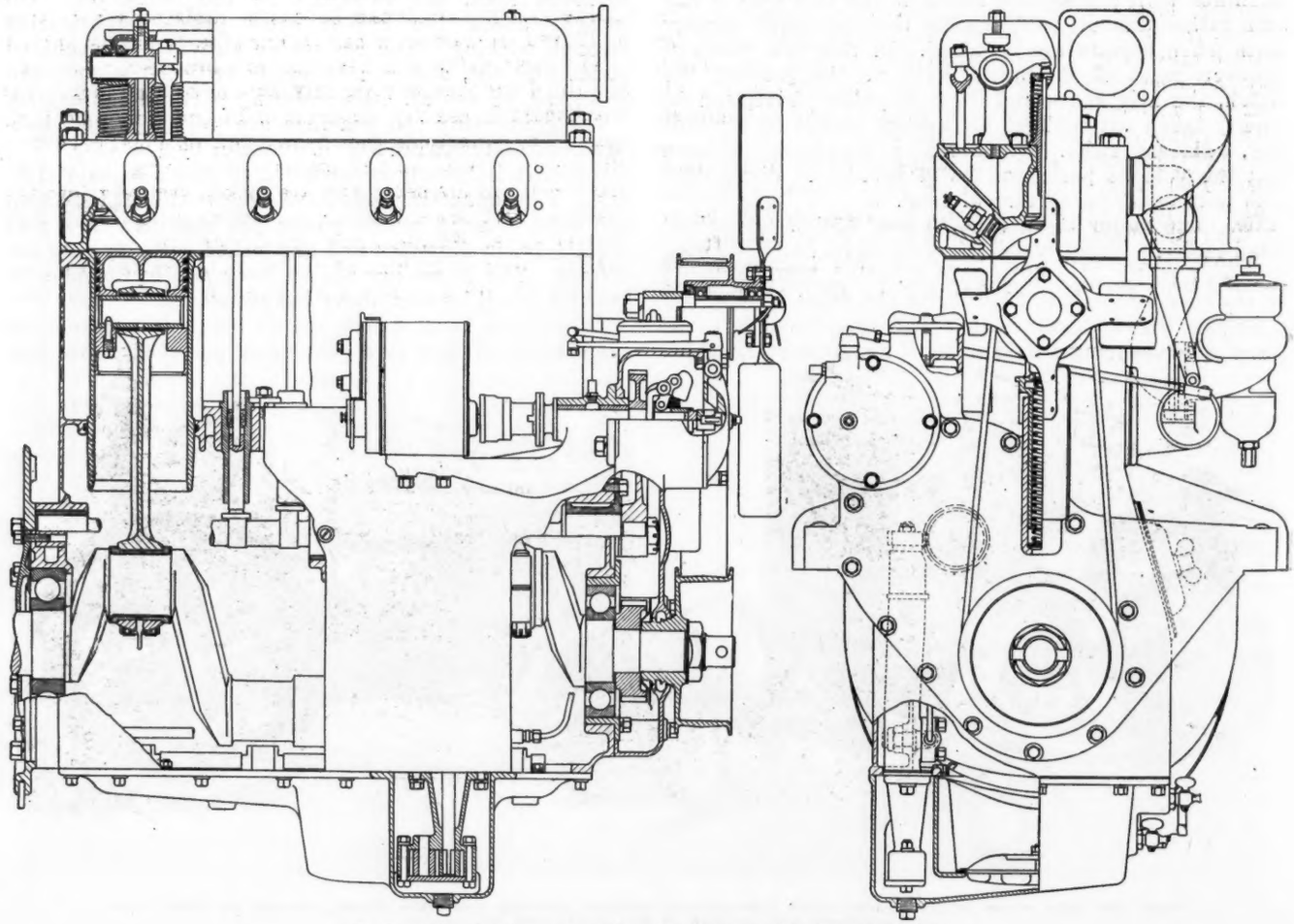
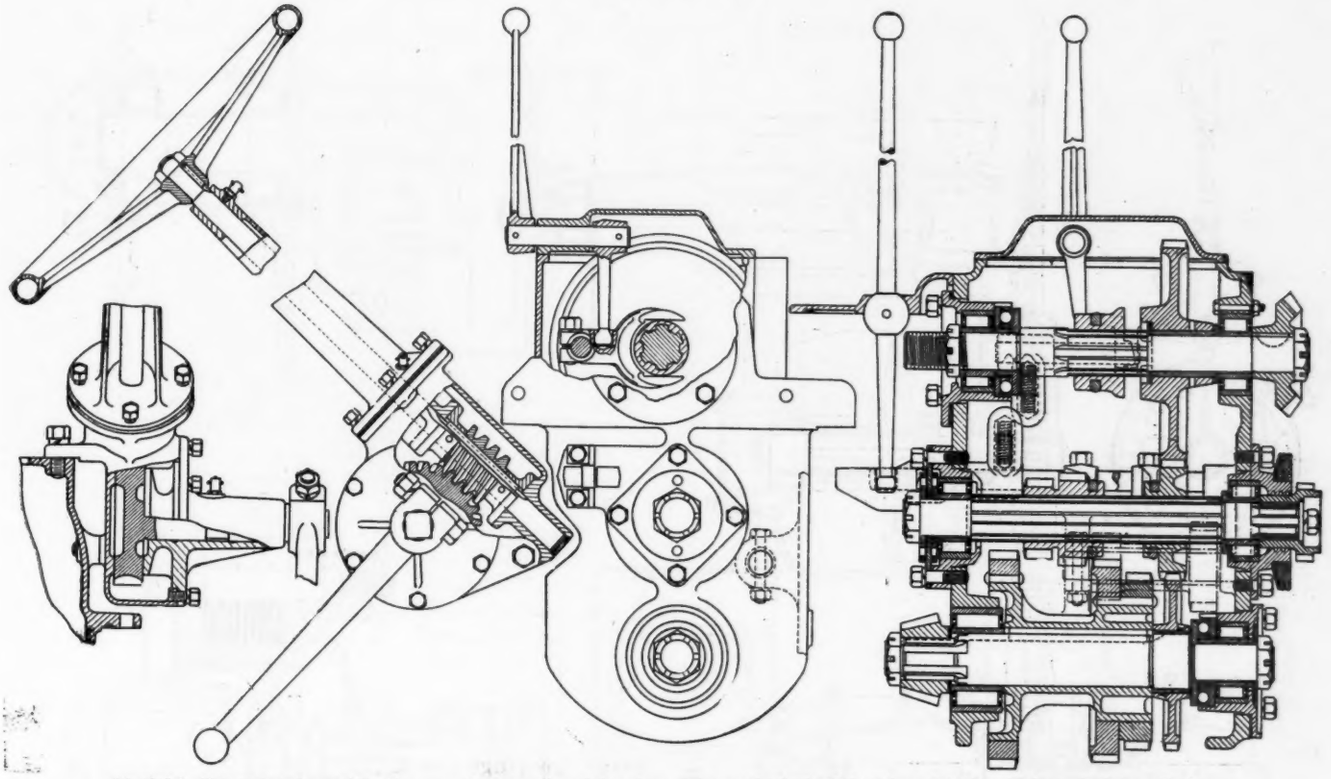


Part sectional views of engine, showing two-bearing crankshaft



At right, the gearset used in the new International tractor. The central shaft is driven by the engine. It drives in turn either the lower shaft, which is geared to the bull pinion shaft, or the upper shaft, which drives the belt pulley. At left the worm and wheel steering gear

from the upper shaft of the gearset. The shaft carrying the belt pulley is mounted in roller bearings, with its axis at right angles to that of the crankshaft. The belt pulley drive gear is provided with a solid jaw clutch which permits of disengaging the pulley shaft. When this clutch is engaged, the belt pulley is operated through the main multiple disk clutch. The belt pulley is so located at the side of the tractor as to give ample clearance for the belt, both at the side and above the front axle. The pulley is 16¼ in. in diameter and runs normally at 595 r.p.m., giving a belt speed of 2530 ft. per minute.

Final Reduction Gears

Just aft of the change speed gear, mounted in the main frame casting and driven by a bevel pinion and ring rear from the lower shaft of the gearset, is the bull pinion shaft. This is short and heavy and is mounted in roller bearings. It can be removed through the side wall of the main frame without disturbing other units. Mounted on the bull pinion shaft, outside the frame, is a brake drum to which is fitted a substantial band brake operated by a hand lever.

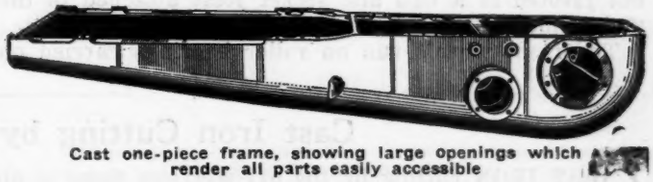
The bull gear and differential are mounted in the main frame casting and tubular extension attached to it. The differential housing and rear axle are carried on roller bearings. The wheels are keyed and clamped to the live rear axle shafts, which latter are provided with hardened steel flanges arranged to take end thrust. These flanges are carried between the main casing and the removable bearing caps or flanges. The wheel and axle can be easily removed by taking out eight flange bolts. The bull gear and differential can then be taken off the frame case, the cover of which is readily removed.

All of the gears in the entire transmission are of steel, carbonized and hardened. The main gears are made from steel rings, which are fastened separately to the carriers so that replacement can be made at minimum expense. All of the transmission bearings, except those on the reverse idler, and the ball thrust bearings, are of the roller type. The entire transmission (gearset, bull gears, bevel gears and differential) runs in a bath of oil which is continuously circulated by the action of the gears.

Special Power Take-off

The tractor is designed to receive a special power take-off, driven from the engine through the transmission. This take-off terminates in a shaft carried in the upper half of the differential casing, and is made accessible by removing a small end cover. This is a special feature which can be readily attached and is expected to find many uses for driving parts of trailing machines of the same general character as those which are now frequently drawn by tractors, but which are now, in general, operated through power taken from driving wheels in contact with the ground. Other accessories, such as power winches, can also be driven from this take-off. An adjustable drawbar is attached to the main frame and axle housing.

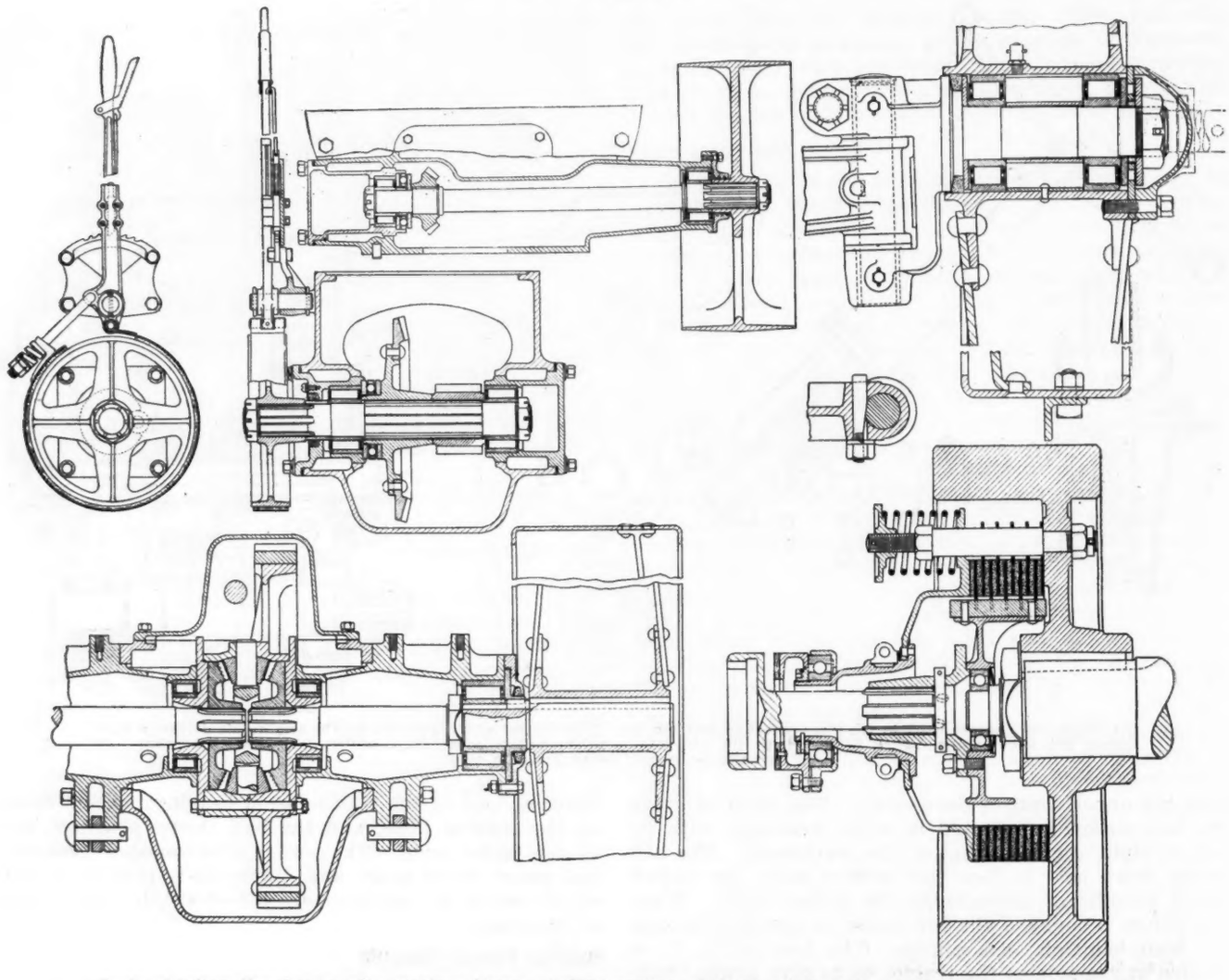
The rear tractor wheels are 50-in. diameter by 12-in. face, and the gear reductions on the three forward



Cast one-piece frame, showing large openings which render all parts easily accessible

speeds are such as to give the machine a speed of 2, 3 and 4 miles per hour respectively. Gear shifting is accomplished in the same manner as in passenger car and truck practice.

The steering gear is of the worm and wheel type, both worm and wheel being of hardened steel. Suitable thrust



Parts of International gear drive tractor: Above, at right, section of front wheel hub; center, belt pulley with its bevel gear drive; at left, bull pinion shaft and hand brake, which acts upon it. Below, at right, the multiple disk clutch; at left, section of rear axle, showing bull gear, differential, thrust flanges, live axle and wheel.

bearings and an 18-in. cast iron steering wheel are provided. The worm wheel is on a horizontal shaft, and the steering arm normally occupies a vertical position. It is connected to the right steering knuckle by a long drag link and thence to the left steering knuckle by a cross link in back of the axle.

The drop-forged front axle is of I-beam section, tapered from center toward the end. The front end of the frame is pivoted at the center of the axle, which is thus capable of considerable angular motions in reference to the frame, without distortion of the latter.

The axle is held rigidly against fore and aft motion by a heavy fork or "wishbone" bolted rigidly to the axle, but pivoted in a ball and socket joint attached to the under side of the main frame.

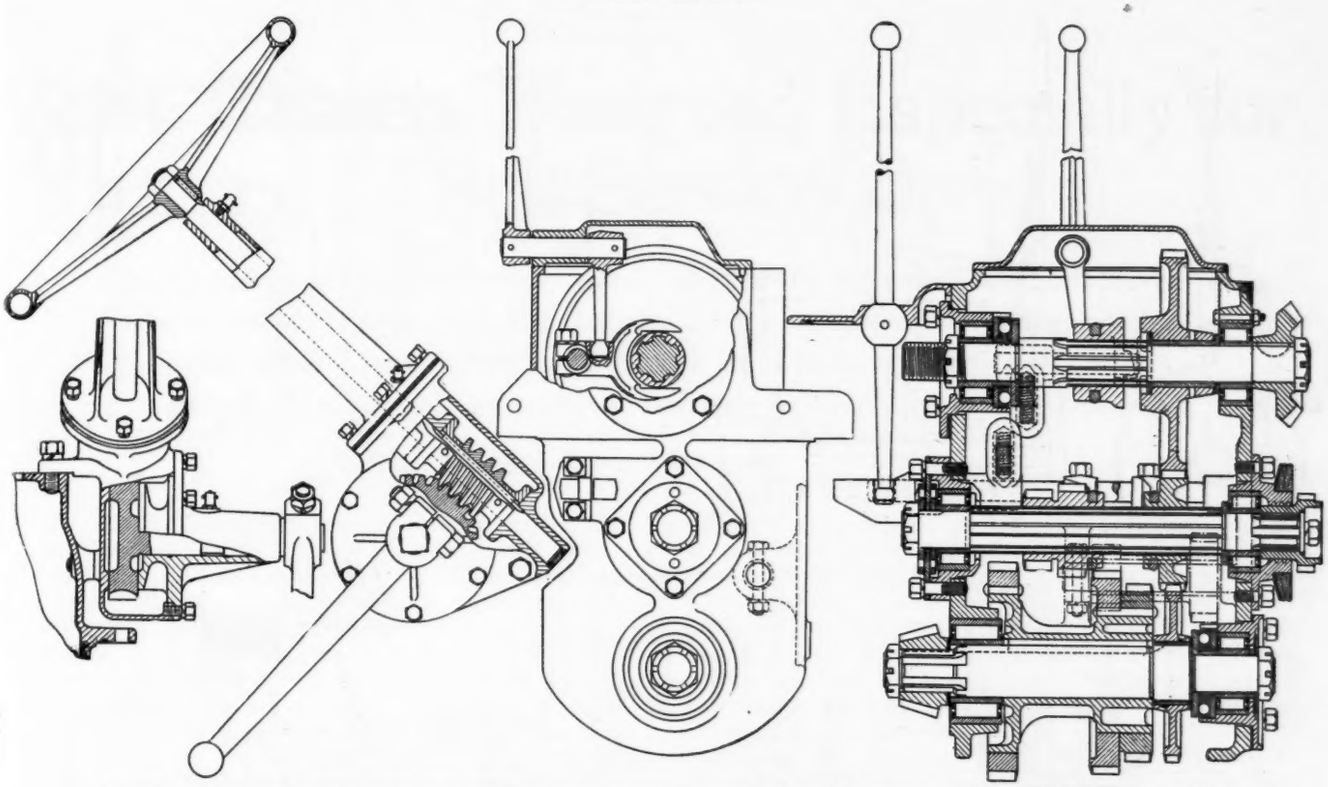
The front wheels run on roller bearings carried on spindles integral with the steering knuckles, similar to automobile practice, except that a hardened steel flange is used to take thrust, in the manner shown in the accompanying cut. The pivot pins are bronzed bushed. The front wheels are 34-in. diameter by 6-in. face and are fitted with removable skid rings. The spindle of the right front wheel is extended through the hub to carry the self-steering device when this accessory is used.

The controls of the machine, which are quite similar in most respects to those used in automobile practice, are placed within easy reach of the driver. Substantial shields are provided over the rear wheels. Extension flanges and an assortment of lugs to suit various soil conditions are supplied when desired.

The few parts outside the main frame which require lubrication are fitted with Alemite connections.

Cast Iron Cutting by Oxy-Acetylene Flame

CAST IRON cutting by the oxy-acetylene flame is an interesting development of the last two years. The cast iron must be preheated to redness over a considerable space. A large and powerful oxygen jet is then directed on the red hot cast iron, with the preheating continued. The kerf made in the iron casting is quite similar to that made in cutting of steel, except that its width is generally double that in a similar sized steel casting and it is not quite so clean looking. It is plain that more gases are used than in similar steel cutting, and it has been noted in tests that the time for cutting is about double that in the case of steel; therefore, cast iron cutting is three or four times as costly as steel cutting and in normal work it can hardly be said to compete with saws.



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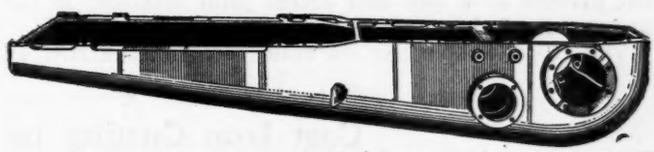

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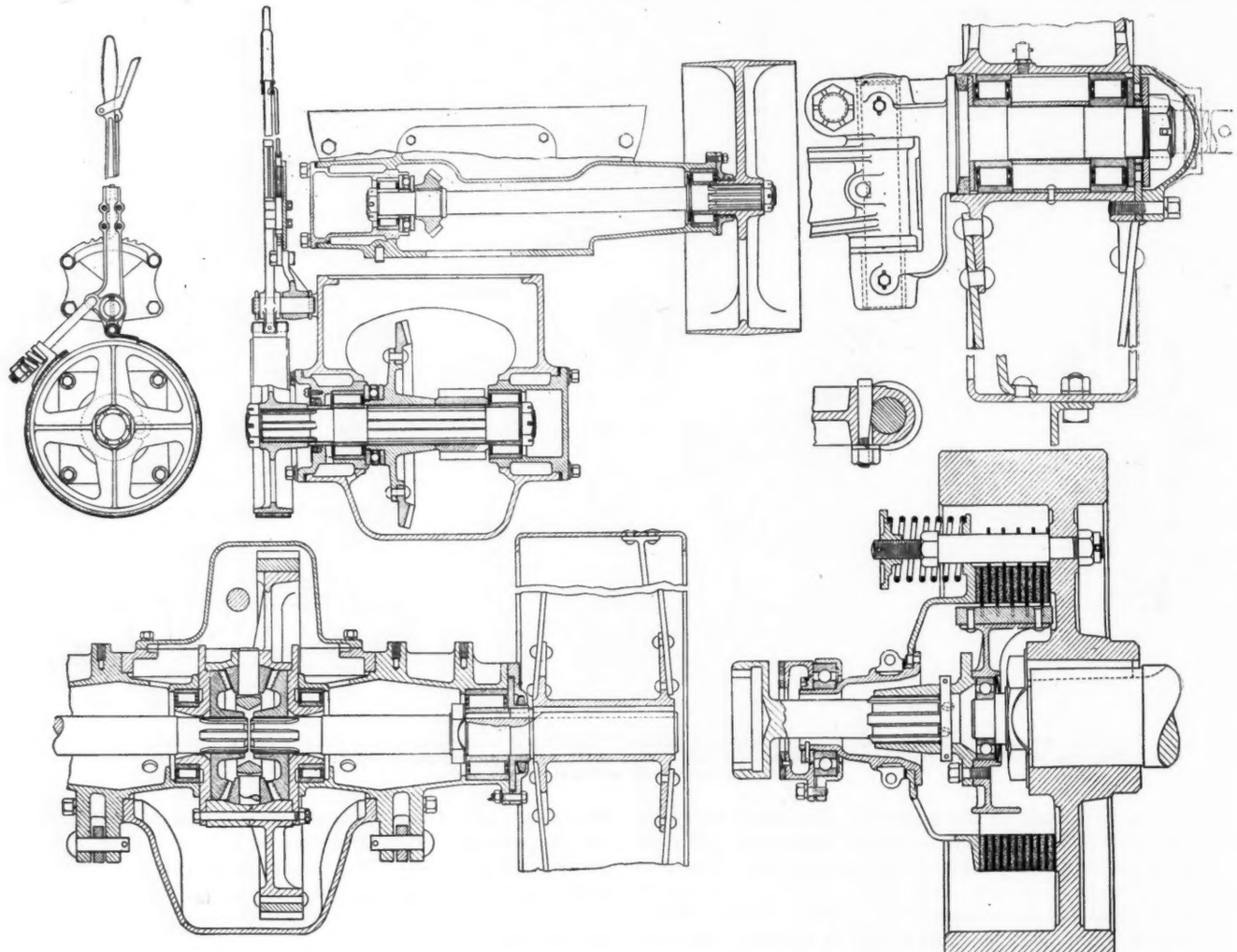

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CAST IRON cutting by the oxy-acetylene flame is an interesting development of the last two years. The cast iron must be preheated to redness over a considerable space. A large and powerful oxygen jet is then directed on the red hot cast iron, with the preheating continued. The kerf made in the iron casting is quite similar to that made in cutting of steel, except that its width is generally double that in a similar sized steel casting and it is not quite so clean looking. It is plain that more gases are used than in similar steel cutting, and it has been noted in tests that the time for cutting is about double that in the case of steel; therefore, cast iron cutting is three or four times as costly as steel cutting and in normal work it can hardly be said to compete with saws.

White Chassis Designed Especially for Bus Service

New product is provided with special, long, low hung frame with out-riggers to support body, long flat springs, 50 h.p. engine and double band propeller shaft brake. Steel wheels with solid tires, or disk wheels with pneumatics can be supplied without variation in height of chassis frame.

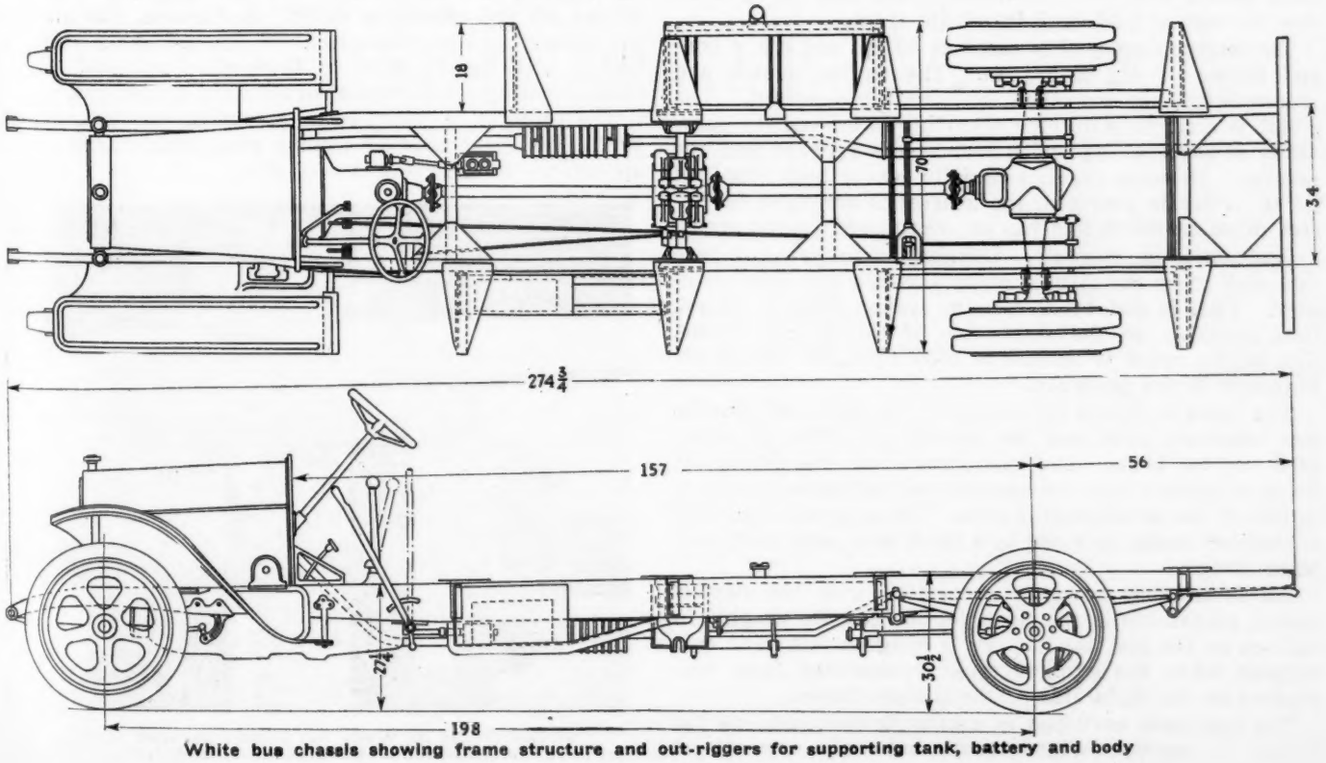
By J. Edward Schipper

A CHASSIS which has been designed specifically for bus service, either in urban or interurban work, has been brought out by the White Co., and has already been put in use in different parts of the country. The chassis is known as Model 50, and it is particularly interesting in view of the fact that it is not a modification of any particular model of White truck chassis, but is designed especially for bus service. A number of features which are important in passenger carrying and are not generally found in the conventional type of truck chassis have been incorporated. As compared with the usual truck chassis, this particular bus chassis has a longer frame, a lower platform height, increased riding comfort and a wider range of speed and acceleration. The chassis frame is designed with sufficient length to mount a body seating 25 passengers without undue overhang. The wheelbase is 198 in., while the overall length of the chassis is 276 in., and the overhang at the rear end is only 56 in. measured from the center line of the rear axle.

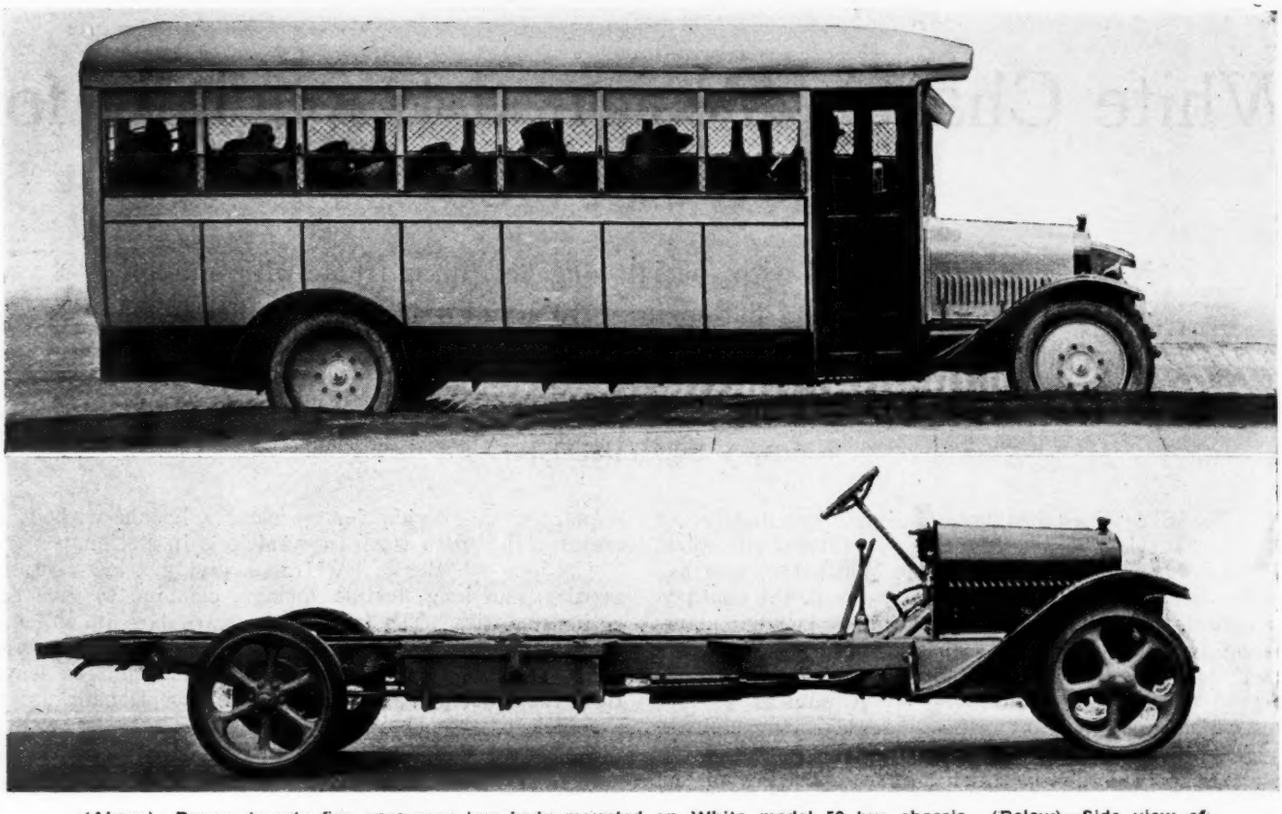
Keeping the loading height of the frame down permits passengers to enter and leave more rapidly and is claimed to have a material effect on the length of stops and, consequently, to provide for a faster schedule without increasing the speed when the vehicle is in motion.

The long wheelbase, low frame, giving a low center of gravity, and long flexible springs, combine to give easy riding qualities. The front springs are 41½ in. in length by 2½ in. wide and have seven leaves. The rear springs are 60 in. long by 3 in. wide and have sixteen leaves. Both the front and rear springs are exceptionally flat for a vehicle of this character.

To provide for a wide range of speed and acceleration, optional gear ratios and transmission ratio combinations are provided to meet the requirements of the particular service. The chassis layout is such that either of two types of wheel and tire equipment can be provided. Steel wheels and solid tires are standard equipment and are especially adapted to operation on paved city streets. For interurban work, pneumatic tires mounted on Budd-Michelin dual disk wheels are available. The use of pneumatic tires does not increase the frame height nor raise the center of gravity on this installation because of the dual arrangement which permits of moderate tire diameter.



White bus chassis showing frame structure and out-riggers for supporting tank, battery and body



(Above)—Brown twenty-five passenger bus body mounted on White model 50 bus chassis. (Below)—Side view of White model 50 chassis designed exclusively for bus service

The chassis weight averages about 5400 lb., but varies with the equipment. The pressed steel frame has a maximum depth of 8 in. at the center. The frame width is 34 in. and the height from the ground 28¼ in. without load at the door position. The standard gear ratio provided is 6.8 to 1, with an option of 7.5 to 1. The tire equipment, standard, is 36 by 4 in. single front with rear 36 by 4 in. dual, or 36 by 7 in. single. The dual disk steel wheels used with pneumatic tires take 36 by 6 in. dual in rear and 36 by 6 in. single front.

The engine employed is rated at 50 hp. and has a bore and stroke of 4¼ x 5¾ in. The engine, clutch and transmission are embodied in a unit powerplant. The clutch is a single plate type operating in oil and the gearset is of selective type with four speeds forward and one reverse. In some cases, especially where both city and rural service is provided, the gearset is arranged for direct drive on third, and has an overgeared fourth speed.

Ignition is by magneto. Lubrication by pressure feed and cooling by centrifugal pump through a cellular radiator. Fuel is fed by a vacuum system from a 35-gal. tank mounted on the right side of the chassis frame. The engine speed is limited to 1550 r.p.m. by use of the Standard White governor.

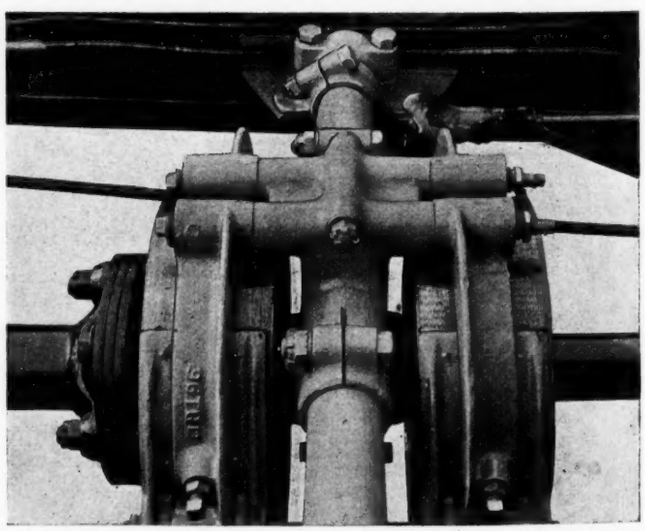
The truck is driven by a divided propeller shaft having one telescopic joint and two universals. The foot-operated service brake acts upon drums on the driveshaft being supported by a cross-member of the frame, as shown in one of the accompanying cuts. The internal expanding emergency brake, operated by a hand lever, acts upon rear wheel drums.

An interesting point in connection with the flexible spring suspension is that in order to keep the weights in balance on the bus, the battery is hung on left hand outriggers, while the gasoline tank is supported from outriggers on the right side of the chassis frame.

The rear axle employed is similar to that used on the Model 20 two-ton White truck, but only one set of brakes, the internal expanding set, is employed. This axle is of the double reduction type. The road clearance is 10½ in. and the gage 60½ in. The front axle is also similar in design to that used in the two-ton truck, but is given a slightly greater drop to facilitate lowering of the frame.

Standard equipment includes a 12-volt Leece-Neville lighting generator driven direct from the timing gears of the engine, and in tandem with the magneto, which is driven off the generator shaft. A 13-plate, 120 ampere hr. battery is also furnished. A Leece-Neville starting motor, with Bendix drive to flywheel, is mounted on the clutch housing when furnished as extra equipment.

The radiator is described as a touring car type, and is formed to accommodate a sloping hood, which adds to the appearance of the completed vehicle.



Service brakes on White bus chassis mounted on the propeller shaft at the point of its division

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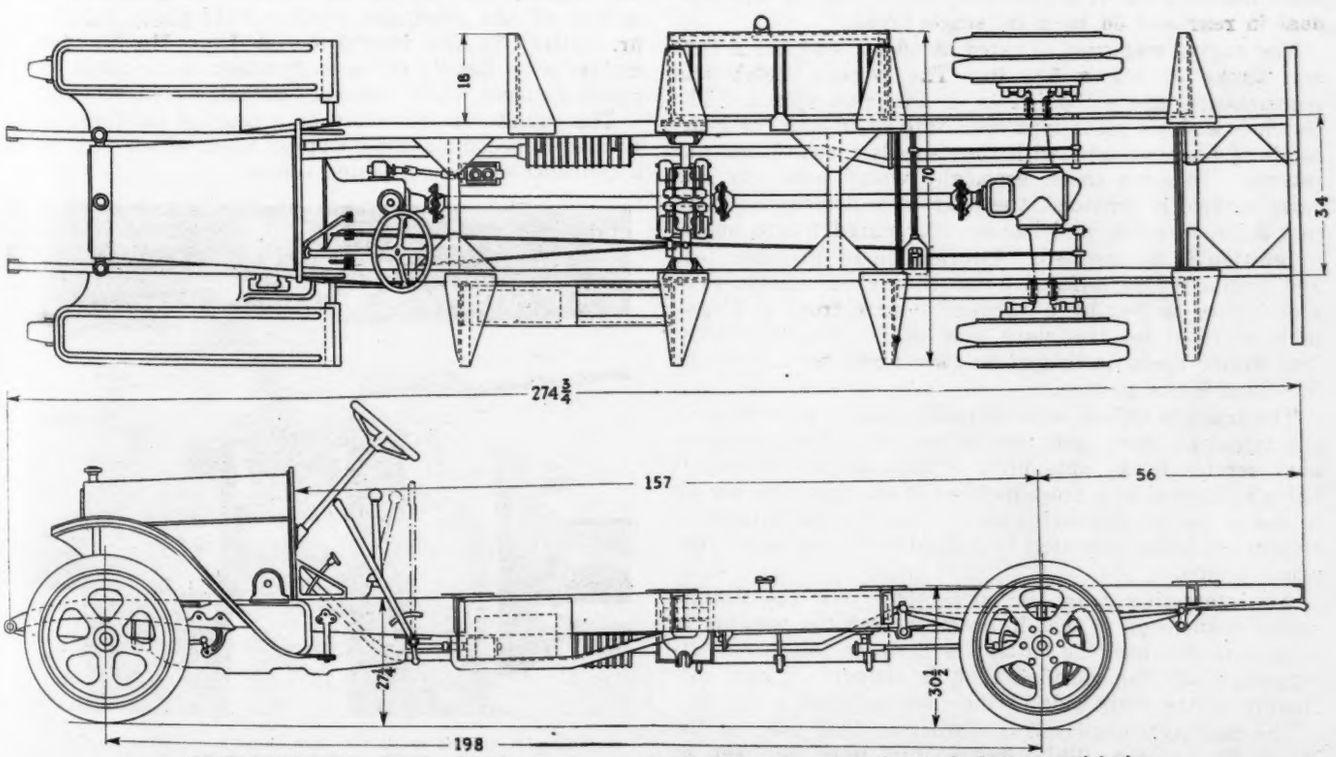

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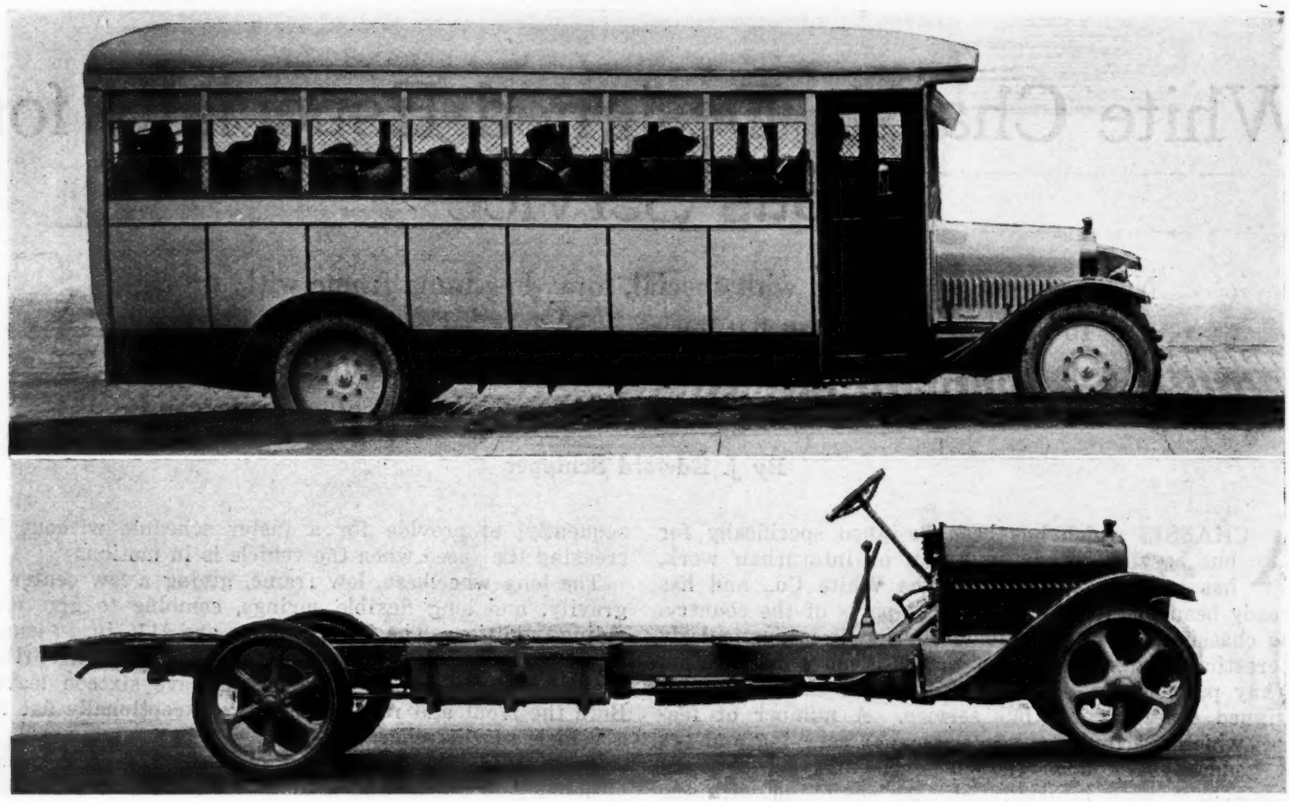

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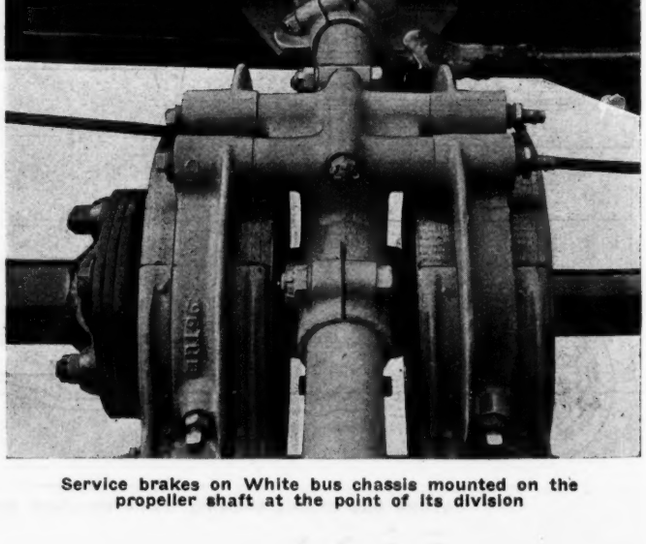


Service brakes on White bus chassis mounted on the propeller shaft at the point of its division

Experience in Development of Cylinders for Air-Cooled Engines

An accumulation of data collected as a result of experimental and design work relating especially to cylinders of high output. The advantages and disadvantages of various types of fins, valves and valve seats, cylinder heads and cylinder material are discussed by a student of this subject.

By S. D. Heron*

IT is proposed to review some of the salient points arising in the design and development of the modern air-cooled cylinder of high output. Investigation has shown that for every brake horsepower developed an average of approximately 0.6 hp., or 25 B.t.u. per min., has to be dissipated directly to the cooling air by the external cooling surface of the cylinder. In addition, 0.4 to 0.5 hp. has to be dissipated by the oil, by conduction to and radiation from the crankcase and similar means. The amount of heat absorbed by the oil will depend largely upon the amount reaching the cylinder and the piston walls and the facilities for cooling the oil. Power output, fuel consumption and cylinder-wall temperatures, such as are quoted herein, are dependent upon liberal splash lubrication and the resultant oil-cooling.

In the light of present-day knowledge a design for a cylinder of high output has to fulfill approximately the following requirements:

1—Develop a volumetric efficiency of 80 to 85 per cent.

2—Produce a brake mean effective pressure of at least 130 lb. per sq. in. at the normal speed on a maximum fuel-consumption of 0.56 per b. hp. hr.

3—Dissipate 25 B.t.u. per min. per b. hp. from the external cooling surfaces of cylinder, this heat to be dissipated so that the maximum temperature of any portion of the exterior of the cylinder walls does not exceed 550 deg. Fahr., and is preferably lower. In addition, the mean temperature of the exterior of the cylinder walls should not exceed 350 deg. Fahr. To produce a layout that fulfills the stated requirements it is necessary that heat-flow be the primary point in mind during design.

The Supply of Cooling Air

As the amount of heat lost to the walls from the charge differs largely in various parts of the cylinder, it is obvious that to have anything like even temperature distribution, the supply of cooling air to any portion of the cylinder should be proportioned approximately to the amount of heat given to that portion of the cylinder.

Considering a normal design of overhead valve cylinder with circumferential cooling fins, it is evident that the side of the cylinder head and barrel that carries the exhaust ports will receive the greatest heat supply per unit area, and therefore should receive the major portion and the greatest effect of the cooling air supply. This requirement is suitably met by applying the cooling blast on the exhaust side of the cylinder. In practice, with such blast application, the circumferential temperature difference at the top of the cylindrical portion of the combustion chamber will not exceed 50 deg. Fahr. Toward the base of the cylinder the circumferential temperature differences will probably increase, but this is usually of little moment, since the maximum temperatures attained there are low. Contrary to the opinion commonly held in this country, the back or side of the cylinder that is in the lee of the blast does not give overheating trouble when the cylinder design is sound and the air supply is suitably arranged.

Cylinder Design

The aim in design should be to remove as far as possible the heat from the cylinder at the point where it is given to the head, ports and barrel. Investigation has demonstrated that neither a material of high conductivity nor an excessive cooling air supply will remedy poor design. A simple cast-iron cylinder with only a small cooling air supply but fulfilling some of the fundamental necessities for efficient heat dissipation will give a performance much superior to that of designs that presume to function by high wall or fin conductivity in conjunction with large quantities of air supplied to those portions of the cylinder where little is needed and a total lack of effective air supply where it is required.

The temperature of an air-cooled engine is determined by the cooling air temperature as a datum point. If the air temperature rises 50 deg. Fahr. the actual cylinder temperatures are sensibly increased by that amount. In general, with an efficient cylinder design, the effect of the air temperature is little felt. A considerable rise in the air temperature increases the cylinder temperature, but it simultaneously reduces the charge weight, and thus to some extent the heat to be dissipated by the cylinder is diminished. A variation of 350 deg. Fahr. in maximum cylinder temperature at full throttle is permissible for short periods of time, such as exist during a fast steep climb by an airplane or the ascent of a mountain by an air-cooled car. That cylinder temperature control is necessary for air-cooled aircraft engines has yet to be proved in practice, although urged as a disadvantage of air-cooling by its opponents. The stabilization of the carbureter temperature is much more likely to be found necessary, due to the rapidity with which an air-cooled engine cools during a glide or dive when switched off or idling.

Many designs have been proposed and many built in which the ingoing charge is presumed to cool the various parts of the cylinder, usually the exhaust valves and exhaust ports. In practice such designs do not function, little or no cooling from the ingoing charge is obtained, and the general result is usually a marked reduction in the volumetric efficiency, accompanied by a pronounced overheating. The ratio between the amount of air required

*Condensed from a paper presented before the Dayton Section of the Society of Automotive Engineers. The author is attached to the Engineering Division of Air Service, U. S. Army.

for cooling and that used for combustion serves to show the unsoundness of attempts to use the ingoing charge for cooling. Further, the cylinder is not the correct place to apply heat to the charge, as heat supplied there can have no beneficial effect on the distribution.

In calculating the air required for combustion a brake mean effective pressure of 130 lb. per sq. in. and an 85 per

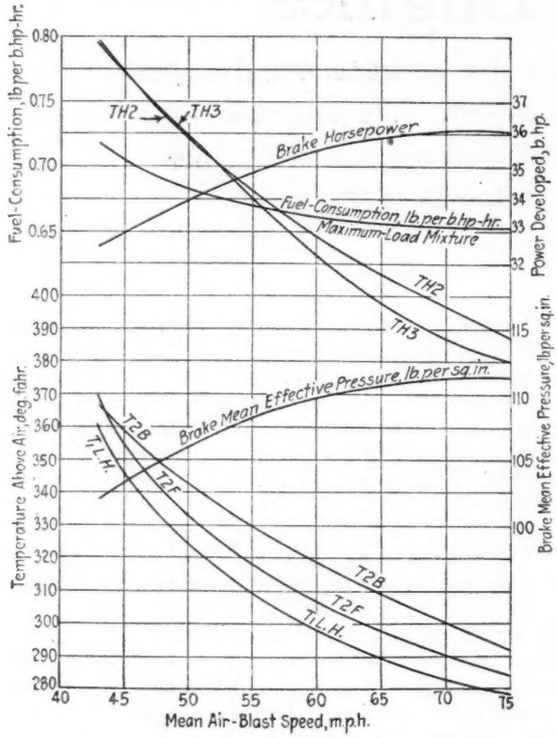


Fig. 1—Effect of the variation of blast velocity upon the temperature and fuel consumption of the Airco cylinder

cent volumetric efficiency in terms of air at the carbureter mouth are assumed. This brake mean effective pressure almost exactly equals 6.1 cu. in. of cylinder capacity per brake horsepower in a four-cycle engine running at 1000 r.p.m. The volume of air per brake horsepower per minute required for combustion is 1.5 cu. ft. and the ratio between the air required for cooling and that needed for combustion is 24.5:1. Although less than 36.7 cu. ft. of cooling air per brake horsepower can be used, and the foregoing calculation takes no account of the cooling effect derived from the latent heat of the unevaporated fuel, nevertheless it gives a measure of the unsoundness of a method of cooling so attractive to many.

An example of what may be accomplished in the way of automobile engine cooling with small air supply is shown by the B. S. A. light car. This car has a 90 deg., two-cylinder V-engine of 66 cu. in. capacity and is cooled entirely by natural draft, no fan being employed. One of the early engines was fitted to a car weighing 1700 lb., including passengers and regular equipment, and road tests of the cylinder temperature under these conditions are of interest. Climbing a hill rising 1200 ft. in 2½ miles, the temperature at the hottest point of the hottest cylinder was 310 deg. Fahr. above the air temperature at the start of the ascent and 495 deg. Fahr. at the finish. This ascent was taken on the run with the engine at normal temperature and was made in a following wind in 11 min. There is little question that the heat-storage capacity of the cylinders is of considerable importance in preventing overheating under such conditions. The heat storage capacity of a water-cooled engine having a large quantity of water in the jackets and the radiator, in this sense a heat accumulator, is known to be of advantage in preventing boiling in mountainous country. This is a parallel tending to show the similar advantage of thick, heavy cylinders for air-cooled engines.

Assuming the average brake horsepower as 10, the mean temperature rise of the cylinder bodies as 100 deg. Fahr. and the weight of the two cylinder bodies as 44 lb.; the heat given to cylinders during the climb is 2750 B.t.u. The heat storage of the cylinders for a given temperature rise equals the product of the weight of the cylinder bodies, the specific heat of the material and the temperature rise, or $44 \times 0.12 \times 100 = 528$ B.t.u. Therefore, 19 per cent of the heat given to the cylinders during the climb was stored therein. This calculation is, of course, only approximate. The assumption as to the brake horsepower and the mean temperature rise of the cylinders are reasonably sound, and even if inaccurate the result serves to show the advantages of heavy cylinders with large heat storage capacity for engines depending almost entirely on radiation for cooling during limited periods of full throttle operation.

Results of Correct Design

A cylinder of sound design, when running at its most suitable compression ratio, will usually develop its maximum power, maximum cylinder wall temperature and maximum tendency to detonation when the air-fuel ratio, by weight, for gasoline and gasoline-benzol mixtures is between 12 and 13 to 1. This mixture strength gives approximately the maximum rate of flame propagation. A mixture strength of 12 or 13 to 1 by weight, when used in a composite aluminum and steel aircraft cylinder, usually results in a fuel consumption of approximately 0.55 lb. per b. hp. hr. with aviation gasoline or aviation gasoline and benzol. This, however, only applies at the most suitable compression ratio. If the ratio be too high, fuel consumptions have to be increased to eliminate detonation. That a fuel consumption of approximately 0.55 lb. per b. hp. hr. usually produces the maximum power and the maximum cylinder temperature is confirmed by Table 1.

The minimum fuel consumption that an air-cooled cylinder will run on is generally a measure of its soundness. In this respect a rather curious difference is noticeable between efficient and unsound design. A poor design will usually work over a wide range of fuel consumption, say from 0.7 to over 1.0 lb. per b. hp. hr. without much variation in the power output, whereas an efficient design

Table 1—Effect of Mixture Strength on Cylinder Temperatures

Power Developed, B. hp.	Fuel Consumption, b. hp. hr.	Air-Fuel Ratio by Weight	Cylinder Head Temperature Rise Above Air, Deg. Fahr.
32.8	0.70	10.5	319
33.2	0.64	11.4	345
33.3	0.57	12.9	385
32.9	0.54	13.5	371
30.6	0.51	15.4	345

will generally show a drop in the power output if the fuel consumption at maximum load of approximately 0.55 lb. be increased by about 15 per cent, the power progressively decreasing with a further increase of the mixture strength.

The reduction in the cylinder wall temperature obtained when the mixture strength is enriched beyond 12 or 13 to 1 may be attributed to the increase of internal cooling by the evaporation of liquid fuel particles and to the reduction of both the rate of flame propagation and the flame temperature.

The circumferential fin, on the whole, appears to have the majority of the advantages. It gives a considerable

stiffening effect to the cylinder that is of advantage in resisting distortion under temperature, explosion and bending stresses. Circumferential finning in general simplifies the problem of best applying the air supply to the cylinders. A combination of circumferential fins for the barrel and the cylindrical portion of the head with circumferential and axial fins or axial fins alone for the crown is used at times and is practically essential for four valve roof head types.

Cylinder Head Design

In general the work on which this paper is based shows that the flat head does not compare favorably, as regards either power output or cooling efficiency, with the spherical or roof types. The reasons for this are plain in my opinion. In the first place, the flat head renders it difficult to maintain the required air spaces between the valve ports and the necessary metal sections between the valve seats without reducing the valve sizes excessively. Large air spaces between the inlet and exhaust valve ports are desirable with three or four valve designs employing a pair of exhaust valves, and it is essential to have a minimum air space of ¾ in. between the adjacent exhaust port walls in such types. Further, with aluminum heads, it is necessary to maintain approximately ⅝ in. as a minimum section of aluminum between adjacent exhaust valve seat inserts; otherwise overheating, distortion and cracking will be apt to occur. It is not wise to reduce this section much between pairs of inlet seats or between adjacent exhaust and inlet seat inserts.

The discharge of an inclined valve in a spherical or roof head appears to be much less disturbed and more likely to promote and maintain turbulence than that of a similar valve in a flat head. The flat head is more liable to deflect under explosion pressure and, in practice, breathing of flat heads is by no means unknown. The truly hemispherical head is the ideal form as regards minimum stress due to explosion pressure.

For two-valve designs the spherical head appears to be the most suitable. For four-valve heads the spherical head is undoubtedly the most efficient, but, except for very special cases, its use does not appear to be justified, owing to the manifest difficulties of valve operation and also to the fact that excellent results are obtainable from a suitably designed roof head. When, however, very large cylinders are required, or medium size designs, either of large bore stroke ratio or to run at such high speeds that sufficient valving in conjunction with good cooling cannot be obtained with a roof head, there is little question that the spherical head is the most suitable design.

Experience to date indicates that for aircraft engine cylinders up to about 170 cu. in. capacity and with bore-stroke ratios not exceeding 1.25 to 1, designed for normal speeds of up to 1800 r.p.m., the roof head will produce the best all-around results. The design of an efficient roof head cylinder is, however, a decidedly tricky proceeding, slight faults in detail being liable to result in poor cooling.

Advantage of High Compression

Relatively high compression is of considerable advantage for air-cooling. It is not likely that any further considerable increase of the possible compression ratio with present aircraft fuel can be secured by any improvement in the design. It is probable, however, that the use of fuel dopes will render possible a further considerable increase. This has been investigated on small air-cooled aircraft engine cylinders and medium size water-cooled aircraft engines: the results have shown a considerable increase in the brake mean effective pressure. Should the proportionate increase of performance prove as large with 160 cu. in. air-cooled cylinders as has been found with the 70 cu. in. types, some rather remarkable performances are likely to be produced in the near future.

Investigation has shown that a steel surface gives 5 to 10 per cent greater heat dissipation than either aluminum or copper. The dissipation of aluminum, however, is improved about 10 per cent by coating with a glossy black enamel, the percentage of improvement varying with the nature of the enamel and the blast velocity. The effect of surface dissipation is of considerable importance and further investigation of the subject is to be made by the Bureau of Standards and the Engineering Division of the Air Service.

The principal alloy that has been used by the British for air-cooled cylinder construction is the Air Ministry 2-L-11 alloy, containing 7 per cent of copper, 1 per cent of tin and 92 per cent of aluminum. This was developed after failure had attended efforts to use the aluminum zinc group, employed so largely on the Continent for crankcase and similar parts. This alloy is both weak and soft when hot, but its bad qualities are, nevertheless, fairly well understood as a result of considerable experience. It sand casts relatively well: the tin content, which reduces the strength and hardness, also seems to reduce shrinkage and pin holing.

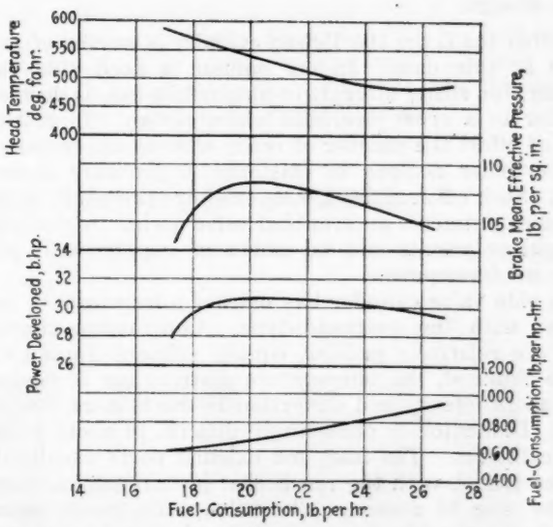


Fig. 2—The effect of fuel consumption upon the output and head temperature of a type D cylinder

For cast aluminum cylinders a fin having a length of from 1 to 1⅛ in., a thickness at the roof of ⅛ in., a thickness at the tip of 1/16 in. and a ⅜ in. pitch is fairly readily cast and is reasonably strong for handling. Fins of a somewhat decreased thickness and pitch can be cast, but are likely to lead to foundry difficulties and are easily damaged.

Use of Cast Iron

Cast iron at present is somewhat despised as a cylinder material. Nevertheless, it can be seen from the B. S. A. and R. A. E. 4D cylinders mentioned earlier in the paper that efficient results are obtainable with this material. I believe that for commercial purposes, excepting aircraft engines, the use of any other material than cast iron for cylinder construction is not justified by the increased efficiency obtained. The use of any more expensive material than cast iron also involves more complicated and expensive construction. In the light of present experience that statement appears to hold good up to an output of 12 hp. per cylinder at about 2500 r.p.m.

Copper has been used extensively for air-cooled cylinders and was employed on some of the earliest air-cooled cars.

The high conductivity is of considerable advantage, but there are many practical objections to its use. One of these is that it is exceedingly difficult to fin a cylinder head efficiently with sheet copper fins. To attach the latter to a spherical head such as the type J cylinder is almost out of the question and in any case entails the use of a heavy iron casting for the body of the head. Some copper air-cooled aircraft engine cylinders were produced in Great Britain during the war. These had a closed end steel barrel fitted with sheet copper circumferential fins, head cooling being attempted by a finned cast aluminum cap. The performance compared unfavorably with that of the composite aluminum and steel type with cast on or screwed in heads. The economical use on a weight basis of copper as a fin material requires the use of thin sheet, and such fins are readily bent and damaged. The copper finned cylinders previously referred to presented an extremely ragged appearance after a short period in service, as handling was sufficient to bend the fins.

Valve Design

Neither the L nor the T-head cylinder is worthy of much notice at this date. In my opinion a good side valve cylinder, for either aircraft or automobile use, is decidedly superior to a crude overhead valve design. In spite of years of effort the number of really efficient air-cooled side valve cylinder designs in existence is probably under a dozen. Such efficient designs as exist are the result of protracted experiment: an overhead valve design to give equal or superior results can be produced readily with practically no development.

The side valve cylinder has marked advantages in comparison with the overhead type. Combustion chamber areas are relatively greater, equally efficient finning cannot be obtained, the temperature distribution is perforce much more uneven and distortion is much more likely to occur. Distortion is exceedingly difficult to avoid in side valve cylinders. The inlet and exhaust ports usually distort the barrel, with the result that piston contact is poor and the ring fit uneven. The valve seats rarely remain true when hot, with the result that grinding in the valves with the cylinder hot is resorted to at times.

The side valve design of necessity departs from the symmetry so desirable for an air-cooled cylinder. For equal class of design and development, the mean effective pressure of a side valve cylinder is usually 20 per cent less than that obtainable from an overhead valve type with continuous full throttle operation. A comparison of cylinders of equal size which is contained in the Internal-Combustion Engine Subcommittee of the British Advisory Committee for Aeronautics Report No. 24 gives, in my opinion, an average figure for the relative efficiencies of overhead and side valve types.

The two-cycle air-cooled cylinder is generally considered to be, almost of necessity, prone to overheating and some consideration of the type is therefore justified. It is not surprising that the average two-cycle air-cooled cylinder should overheat, as it is usually a very light, thin and poorly finned cast iron type. However, efficiently cooled cylinders for two-cycle engines are now produced.

The use of aluminum perhaps is justified commercially for two-cycle cylinders for air-cooled motorcycle engines, for the cooling conditions on such engines are usually very arduous. With cast iron combustion chamber the carbon deposit is both more adherent and of greater quantity than with one of aluminum.

Valve Seat Inserts

Valve seat inserts are a frequent source of trouble in aluminum cylinder construction. Conditions require an insert that has a tight fit and good thermal contact with the cylinder head metal when both are hot. The use of cast iron or steel inserts is not good practice, regardless of how they are fitted, as the coefficients of expansion of cast iron and steel are only 30 and 40 per cent respectively of that of aluminum. Cast iron or steel inserts if cast in are very liable to cause blowing of the aluminum surrounding the insert. Aluminum bronze has, on the whole, proved the most successful for cast in seat inserts.

Cast in inserts are a poor production proposition in the foundry. They are exceedingly liable to shift on the core when in the mold and cause the bore of the insert to be eccentric with the outside when finish machined. The cast-in insert of any material is prone to develop defective thermal contact or even to come loose. Due to casting shrinkage the insert initially may be tight in the cylinder head when both the head and the insert are hot. As a result either of annealing in the course of production or of the gradual annealing that occurs in operation the casting shrinkage is ultimately largely removed. The less the difference is in the coefficient of expansion of the material of the head and the insert, the greater will be the chance of a cast-in insert remaining tight. Aluminum bronze cast-in inserts have on this account proved markedly superior to steel or cast iron. Cast-in inserts are an example of evading a design issue at the expense of the foundry.

In general, exhaust valve cooling has two distinct phases, cooling through the seat and cooling via the stem and the guide. If either be at fault, inspection when running on open exhaust will determine which is the offender. For efficient seat cooling as effected by valve design, I prefer a tulip valve with a thick rim, possessing greater circumferential conductivity than the flat head valve, and the use of a wide valve seat. The width of the valve seat undoubtedly has a marked effect upon the heat flow from the valve to the cylinder head, as the intensity of the heat flow will depend on the area of the valve in contact with the cylinder. The heat flow from the valve to the cylinder will be affected to some extent by the load of the valve spring: from this standpoint the greater the load the better.

Efficient stem cooling is assisted by extending the valve guide and guide boss down as close to the head of the valve as possible, and shrouding the guide with a heavy boss that is able to conduct away the heat abstracted from both the valve stem and the exhaust gas. The cooling via the valve stem is partly controlled by the sectional area of the stem and the area of the stem in contact with the guide.

Valve Cooling

Claims that the exhaust valve cooling of air-cooled engines is as good as that of water-cooled engines may appear to be an exaggeration. Nevertheless, such claims are not merely my personal opinion, but can be confirmed readily by the Engineering Division of the Air Service.

For an air-cooled engine the results appear to indicate that:

1—The exhaust and the inlet valves should be of approximately equal diameter and have equal lifts.

2—A mean gas-velocity through the valve annulus of from 140 to 160 ft. per sec. seems to give the maximum performance with valves of between 1⅜ and 1⅝ in. diameter.

The first conclusion has exceptions, as in large two valve cylinders the exhaust valve is often made smaller than the inlet for valve cooling reasons with satisfactory results. Such an arrangement usually requires an excessive exhaust opening period to produce the best results, in spite of running generally at a somewhat lower speed than the four-valve type.

Experience tends to show that with an increase of the valve size the velocity through the annulus can be increased considerably without affecting the brake mean effective pressure. This is probably due to the decrease in friction in the port, owing to the increase of the ratio between the port area and the maximum area in the annulus.

In reply to an invitation to discuss this paper, Thomas Midgley, engineer of the Fuel Section of the General Motors Research Corp., stated that his experience had been more largely with cylinders of smaller diameter than those discussed in Mr. Heron's paper. He expressed the opinion, however, that the general principles, as outlined by Mr. Heron, would no doubt apply. Lester S. Keilholtz, chief engineer of the Delco Light Co., also stated that his experience had been with engines running about 6 hp. per cylinder and consequently he was not in a position to discuss the larger cylinders referred to.

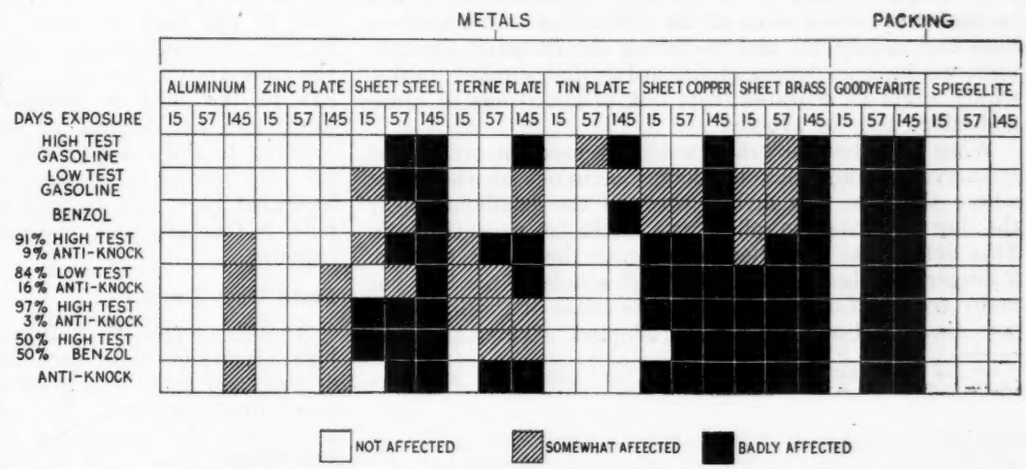
J. H. Hunt, research engineer of the Dayton Engineering Laboratories Co., expressed the opinion that it would have been a good thing if everyone had experimented with air curves showing the cylinder temperature secured with different mixture ratios. This, he says, was true regardless of whether the engine experimented with were water-cooled or air-cooled. He stated that in experimental work, if the radiator temperature after a change of mixture were noted, we would know more about engines than we do by simply trying to keep the temperature constant by connecting with city water sources.

H. M. Crane stated that this paper is a challenge to everyone who is designing water-cooled engines. He stated that the paper is of value to the designer, as it shows where high temperatures occur, and this is equally essential whether water or air cooling is used. He dwelt to some extent on the advantages of water cooling, one of the advantages mentioned being that the air-cooled engine delivers the heat to the atmosphere directly from the cylinder, whereas the water leads it away and dissipates it at a point remote from the cylinder itself. He stated that in aviation cooling in the slip stream is a disadvantage, as it is apt to be a factor in head resistance beside resulting in construction which cuts off the pilot's view.

Considerable discussion developed around the advantages of the air-cooled cylinder in extremely cold countries as well as in desert areas where water is hard to obtain. The consensus of opinion seemed to be that for this type of service, the air-cooled cylinder had already proved itself to be highly satisfactory. The use of air-cooled radial engines by the British in the Mesopotamia countries was cited as an example of this.

Effect of Doped Fuels on the Fuel System

THE use of anti-knock compounds in aircraft operation has become practically a necessity, and for two main reasons, viz., the constantly increasing use of higher compression ratios and the necessity for the use of a cheaper fuel. The Material Section of the Engineering Division, War Department, Air Service, McCook Field, Dayton, Ohio, has made an investigation of the effect of these doped fuels on the fuel system. According to the reports issued it was found that corrosion of the fuel tanks and the subsequent accumulation in tubes and strainers of the corroded matter, due to the use of anti-knock compound, caused obstructions of the gasoline line. Aluminum and zinc are very slightly affected, if at all, by the doped fuels, but copper, brass, terne plate and iron are badly affected. In making the experiments, the following fuels were used:



Effect of doped fuels upon fuel system in the presence of moisture

High-test gasoline, low-test gasoline, anti-knock compound, 91 per cent high-test gasoline containing 9 per cent anti-knock, 97 per cent high-test gasoline containing 3 per cent anti-knock, 50 per cent high-test gasoline containing 50 per cent benzol and 84 per cent low-test gasoline containing 16 per cent anti-knock. The anti-knock compound referred to is anti-knock No. 1, and was obtained from the General Motors Corp. Research Laboratory. This anti-knock compound is said to be composed of 70 per cent aromatic amines and 30 per cent benzol. The amines are probably orthotoluidine, paratoluidine, xylidine, aniline or mixture of these. A diagram of the results of the investigation is given herewith. It may be observed that the metal which stood up better than any other is aluminum. Next comes zinc and third tin, while steel, terne plate and particularly copper and the copper alloy, brass, are very badly affected by fuels containing anti-knock compounds. The presence of moisture materially increases the effect of these compounds on the metal.

Manufacture of Cast Segmental Wheels

THE Van Wheel Corporation, whose sectional wheel was recently described in these columns, states that, while the manufacture and assembly of the segmental sections, of course, requires certain operations of machining and locking the joints not required in one piece wheels, there are, on the other hand, several operations eliminated in this type of construction which are necessary in a one-piece cast metal wheel. These include: grinding the sides of the wheel, chipping the heavy flash which appears in the one piece castings and not in the segmental section castings, and turning off the excess metal required when pouring a one piece casting.

It is claimed also that the need for truing up is less in the segmental wheel. Beyond this the advantages of lower weight and less material are claimed.

Seamless Steel Tubing in Motorcycle Construction

The tapering of a steel tube in diameter or gage often reduces its weight and increases its strength. In this article the author emphasizes the need of using suitable quality steel and shows a very simple method by which the carbon content of steel can be determined to within 0.025 per cent.

By W. W. Hackett*

SEAMLESS steel tubing is a product of modern times, some fifty years having elapsed since it was first produced commercially. Its use has made possible the manufacture of articles which could not otherwise have been made, while it has also been the means of popularizing the use of articles which, before the introduction of steel tubing into their manufacture, found only a small sale.

From past experiments and errors we gain knowledge of what is practicable and learn what to avoid in the use of steel tubing in cycle and motorcycle construction. It will be useful to review some of the difficulties with which we have had to contend, and to discuss the remedies for failures we have experienced, in order that similar faults, which might be repeated from lack of knowledge of cause and effect, may be avoided.

When the Bowden brake was first used on cycles and motorcycles, numerous breakages occurred at the point where the hole was drilled through the handlebar near the lug in order to allow the cable to pass through. This defect was remedied by passing the cables through a properly designed lug, or through a hole in the lug, but many accidents occurred before the cause of the breakage was discovered and the remedy adopted. Under an alternating stress a tube that has been drilled, unless properly reinforced, is very likely to fail. For the purpose of proving the weakening effect of a hole, in a tube, quite a large number of running tests on drilled and undrilled tubes were carried out on the special machine shown in Fig. 1, and in some cases the undrilled tube had from ten to twenty times the life of the drilled one.

Having found that, when the tube was subjected to a fiber stress of 20 tons, the drilling of a hole reduced the number of revolutions while under alternating stress to one-tenth, or even to one-twenty-fourth, it was discovered that if the area of metal removed is replaced by two 1¼ x ⅝ in. oval patches merely sweated on each side of the tube around the hole, from 70 to 80 per cent of the life of the tube is restored. Continuing along these lines, two half-bushes, about 2½ diameters long, were sweated to the sides of the tube, whereupon the life of the tube proved to be practically the same as that of the undrilled tube, and instead of a break occurring at the hole, a fracture took place at the chuck of the testing machine.

*Paper read before the Institution of Automobile Engineers, condensed.

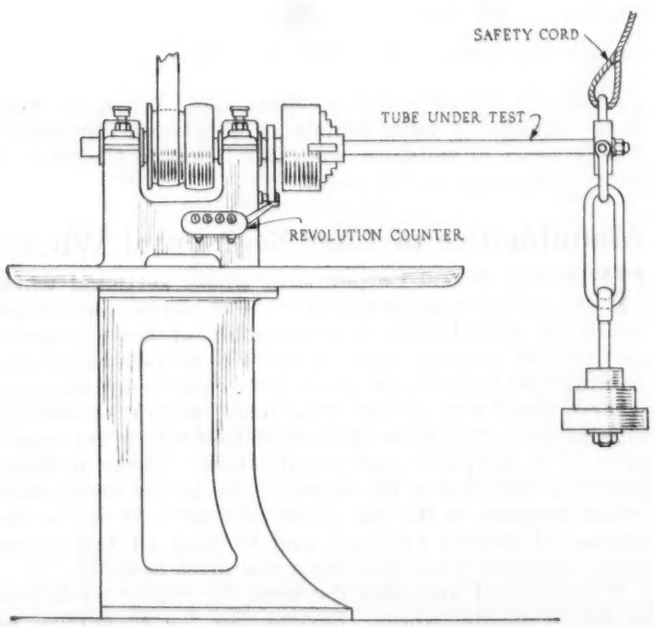


Fig. 1—Alternating stress endurance machine

Tests With Lugs

Another series of failures was caused by unsuitable lugs. Some of those used in the earlier days of motorcycling had very strong outlets, and case after case of tube failure occurred. The tube often broke off so cleanly as to give the appearance of having been cut through. The broken tube could be flattened, thus proving that it was in a ductile, and not brittle, condition, and a series of tests was carried out in order to prove that the fault lay in the excessive strength of the lug outlets. A lug having strong outlets was taken, and one outlet only being tapered off. A piece of tubing of the usual size and quality was brazed into the lug, the lug then being firmly secured to a plate. The ends of the tube were then moved by eccentrics and connecting rods, giving a half-inch movement at a speed of about 400 r.p.m. Each time the experiment was tried the tube broke off cleanly close to the thick outlet, whereas it was always intact at the tapered outlet.

In another test two tubes brazed into lugs, one with a thick and the other with a tapered outlet, were held rigidly by the lugs and similar weights were applied at the ends. The tube brazed into the lug with a tapered outlet bent with an easy curve, but that brazed into the lug with a strong outlet bent abruptly close to the lug.

Alternating stress tests were also carried out on a number of tubes held in grips, half of which had tapered outlets and the others strong outlets. When the taper grip was used the average number of revolutions before breakage occurred was 248,371, but when the strong outlet was used, breakage occurred after only 120,545 revolutions, or

less than half the number experienced in the case of tapered outlets.

Research work carried out also demonstrated the improved condition of the tube after blueing. The alternating stress tests proved that a longer life could be obtained than was possible in the bright-drawn condition, and blueing, which was specified by the Air Board as heating up to a temperature of between 380 and 450 deg. Cent., was insisted on. There is no doubt that when tubes are to be soldered into position they are better for the blueing, but when they are to be brazed the value of the operation is negatived.

It has been proved to the satisfaction of many cycle and

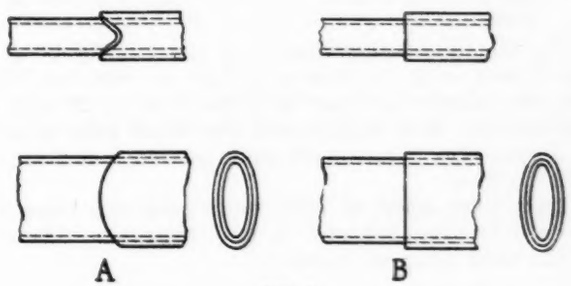


Fig. 2

motorcycle engineers, that to keep on merely increasing the gage of a tube that appears to be too weak for its work is not always good practice. For instance, take the case of the front fork tube as used on the ordinary cycle. This tube has proved of ample strength for use on the highways of this country, but for Continental roads something better was wanted. Some years ago the author's firm supplied a large quantity of front forks produced from 19 gage tubes to Russian cycle manufacturers. We were asked to increase the thickness to 18 gage as a number of breakages had occurred. We did so, but matters were not improved, and we were then requested to further increase the thickness to 17 gage. There was still no improvement; indeed, the number of breakages increased. The forks all broke off where they were brazed into the crown, and we were asked by the Russian manufacturers to help them out of their trouble. One way of doing this would have been by using a suitable liner or sleeve, but we tried another method which proved quite successful. We brought back the gage of the tubes to 18 where brazed into the crowns, and tapered the gage to 22 at the bottom ends. This proved effective, and thus a lighter article by about 40 per cent from the same quality steel stood the strain successfully. The result is accounted for by the fact that the shock was more equally distributed along the tubing, due to the strength being reduced gradually away from the brazed portion, whereas in the plain gage tubing the whole of the movement was concentrated in a very small space near the crowns.

Running Tests on Front Forks

The author has carried out quite a number of running tests on front forks of various tapers, reducing to what may be thought to be ridiculously small diameters at the bottom of the fork, but the life of the fork increased as the size at the bottom diminished. In many cases weight can be saved and increased strength be given by a tapering of the tube in diameter or in the gage.

Alternating tests have been carried out on 1 in. by 20 gage steel tubing, both in parallel lengths and with a taper of ½ in. per foot. A weight of 111.56 lb. was suspended from each tube at a distance of 12¾ in. from the grips, giving 25 tons per sq. in. stress. The average number of revolutions borne by the plain pieces was 25,987, while the tapered pieces, which were 7½ per cent lighter, broke after 30,891 revolutions. In both cases the break in the plain tubes was straighter than in the tapered tubes.

A pair of front-fork tubes, having a D-section at the top portion and tapered to 9/16 in. round section at the bottom, was brazed into the crown. A weight of 130½ lb., giving 15 tons stress per sq. in. at the crown, was suspended from the tubes, which broke at the crown after 1600 revolutions.

Another pair of forks, of a similar section at the top to those used in the previous experiment, but tapered down to 5/16 in. diameter at the bottom, was tested in the same way, and broke at the crown after 3180 revolutions. While it will be recognized that this is not an ideal method of testing front forks, it does demonstrate effectively the mechanical advantage gained by reducing the strength away from the breaking point of a tube. Numerous examples from nature's handiwork can be cited to show that this principle is a naturally sound one. In the bones of human beings, animals, fishes, and birds, or in the trunks, branches, and twigs of trees, it is seen that the slow process of evolution has produced the design best suited to withstand the natural forces with which certain embodiments of life have to contend, and that all the parts mentioned have assumed a tapered form.

Value of Taper-gaging

On motorcycle frames it is possible greatly to decrease the weight of the tubes by a proper distribution of the strength. The motorcycle manufacturer knows at which part of the frame breakage occurs. In many instances the front down-tube has been the vital part, and the break has occurred close to the top lug. It is much better to put in a taper-gage tube to prevent the trouble than merely to increase the gage. If a 12 gage down-tube has previously been used, a tube of the same weight, but tapered from 10 to 14 gage in its entire length, will, no doubt, remedy the defect. The tube is stronger because of its added thickness at the critical point, and also because the tapered gage enables the fatigue to be carried away from the lug. A 12 to 15 gage or a 12 to 14 tapered gage would be stronger than the 12 gage plain tube. Another place where breaks have occurred is at the front of the top tube. This weakness can be removed by butting or taper-gaging the tube.

Front forks are a critical point on a motorcycle, and to a great extent determine the shocks the frame has to take. The proper springing of a front fork takes away a good proportion of the shocks from the frame, the springs themselves absorbing the strains. The more the shocks are absorbed by the springs, the less the tubing is fatigued. It is possible to use springs too strong for their work, and

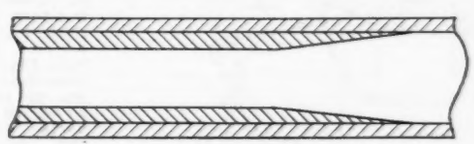


Fig. 3

too great a factor of safety on a spring may mean an increasing strain on the frame. After stronger springs have been put on the forks, the author has seen breakages occur in the steering columns or fork tubes when these parts were previously satisfactory.

The tubes on front forks are always liable to fatigue, and breaks often occur against the lugs. The builders cannot take too much care in the production of these forks, as there is often a thinning of the tube at the point of junction with the lug, caused by filing after brazing. It is much better to leave some trace of brass there than to

take the steel away. The lugs should be kept as light as possible at the outlets, and a lug with a curved shape at the outlet as illustrated in Fig. 2-A is better than one with the square-cut outlet generally used, Fig. 2-B.

Some makers "liner" the fork blade, and this is a very wise procedure, as in the case of fracture of the blade there is a support that may prevent an accident, but the value of a liner in preventing a fracture is very small indeed. In order to lessen the risk of fracture of the tube, the liner may be soldered or brazed to the tube. Should the break occur, however, the liner will probably give way at the same time as the blade. The disadvantage of this practice is that no warning is given, whereas when a loose liner is used the fracture of the outer tube is noticed before a complete break occurs. The blade with a liner

Fig. 4—Re-Inforcing tubing

soldered or brazed in has, however, a longer life before a fracture takes place. It is always advisable, if a liner heavier in gage than the tube it is intended to reinforce be used, to taper the gage at the ends of the liner gradually to below that of the outer tube, as in Fig. 3.

The efficacy of a liner depends upon the position of the reinforced tube in the frame of a machine. Take, for example, the reinforced tubing shown in Fig. 4. These sections, where bending or compression strains occur, are most useful, but where the tubes are in tension they are not satisfactory. In the case of the front down-tube of a motorcycle, which has the vibration and weight of the engine to counteract, the strain has to be borne almost entirely by the outer tube. If this fractures, it will draw away from the inner tube, unless the inner and outer tubes have been properly brazed together. Numerous experiments have been carried out which have proved these points. Alternating stresses were applied to front forks, various lengths and thicknesses of liners being used. The longer the liner, the better the result obtained. The break, however, still occurred at the lug, but the brazing of a piece of steel on to the outside of the blades strengthened them sufficiently to make the steering column break instead of the forks. These tests are illustrated by Fig. 5.

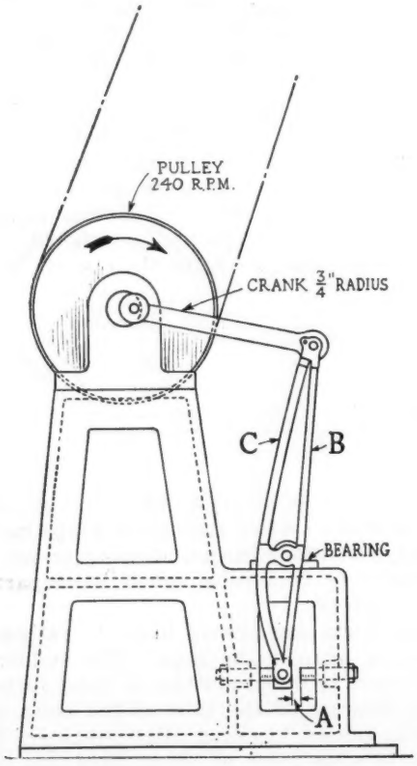


Fig. 5—Testing Machine for motorcycle forks. Dimension "A" is so arranged that the fork under test shall move at this point ¼ in. less than the theoretical movement (according to the dimensions of machine parts and fork), this making the fork bend, i.e., tubes "B" and "C" are alternately in tension and compression

The following tests seem to prove conclusively the added value given by a tight-fitting liner. The only way to ensure a liner being tight is to draw it into position, the liner being expanded against the tube, or the tube being drawn tightly round the liner.

Alternating-stress tests on tubes with tight- and loose-fitting liners

Size of outside tubes.....1 in. by 20 g.
Thickness of liners .....20 g.

For the tight-fitting liner tests the 1 in. by 20 g. tube was drawn on to the liner and then cut into test lengths. For the loose-fitting liner tests the 1 in. by 20 gage tube was cut into test lengths and the liners were pushed in by hand. The 1 in. by 20 gage outside tube was tested with no liner.

Tests were made on plain tubes held in a loose socket and also on tubes brazed 1 in. into thick lugs. The results of the tests were as follows:

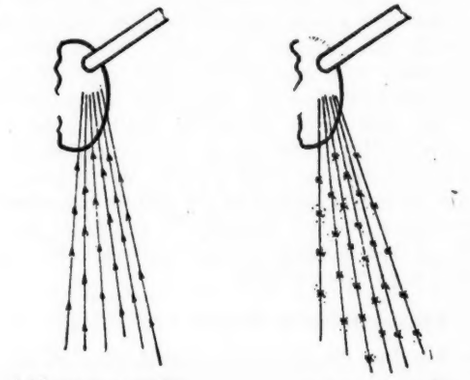
(1) Tight liner. Stress at socket 20 tons.
Plain tube broke at socket at .....95,647 revs.
(2) Loose liner. Stress at socket 20 tons.
Plain tube broke at socket at .....23,579 revs.
(3) Tight liner. Stress at lug 20 tons.
Brazed joint broke at lug at ..... 2,579 revs.
(4) Loose liner. Stress at lug 20 tons.
Brazed joint broke at lug at ..... 503 revs.
(5) Tight liner. Stress at lug 15 tons.
Brazed joint broke at lug at ..... 9,886 revs.
(6) Loose liner. Stress at lug 15 tons.
Brazed joint broke at lug at ..... 2,746 revs.

In the plain-tube tests the outer tubes and the liners broke, but in the brazed-joint tests the outer tubes only broke.

1 in. by 20 gage outside tube only

(7) Plain tube. Stress at socket 20 tons.
Broke at socket at .....12,811 revs.
(8) Brazed joint. Stress at lug 15 tons.
Broke at lug at ..... 2,614 revs.

Besides using means such as tapering, etc., for over-


0·15 per cent carbon. 0·5 per cent carbon.
Fig. 6

coming possible weakness, too much care cannot be taken to put into the different members steel of a suitable quality. From experiments carried out during the war period on airplane tubing, it was found that excellent results could be obtained by using 0.5 per cent carbon steel tubing, giving in the bright or blued state a yield of 40 to 45 tons per sq. in. and an ultimate stress of 45 to 50 tons per sq. in. When annealed, the steel should give

23 tons per sq. in. yield and 35 tons per sq. in. ultimate. The author found, however, that in the motor trade there was no inclination to use these high-carbon steel tubes, and opinions were expressed that the tubing from this steel would of necessity be brittle. While it is recommended that care should be taken with the heat-treatment, the whole of the author's testing has been carried out on joints brazed in his shops in a commercial manner, with no more care taken than in ordinary production. Although hundreds of tests have been carried out, he has not had a contradictory result, the value of carbon steels being proved; 0.3 per cent carbon tubing has always been better than 0.15 per cent, and 0.5 per cent always superior to 0.3 per cent.

Sometimes there is uncertainty as to the grade of steel of tubing carried in stock. The tube maker may get some wrong billets from the steel maker, or mistakes may occur in transit or in the tube works. If any test is to be made to check the carbon contents on commercial lines, that test must be a cheap one. The "Spark test" for carbon is a quick method, and, in the hands of a capable and properly trained man, the percentage of carbon in the steel can be determined to within 0.025 per cent.

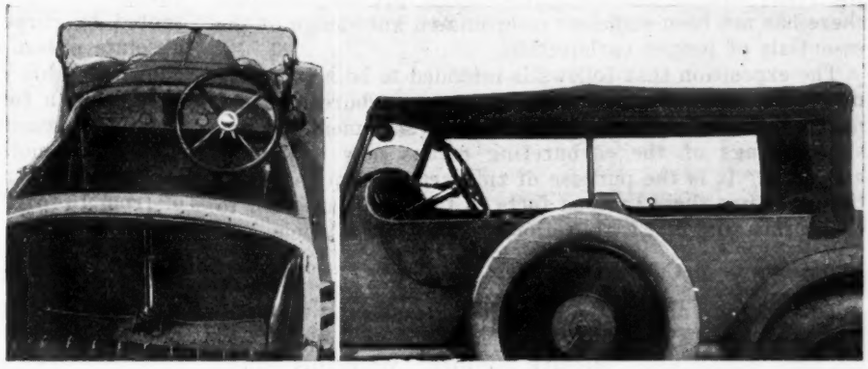
When a piece of steel is pressed against a grinding wheel a shower of sparks is produced, and this shower may be called a "spark-sheaf." The spark-sheaf consists of spark rays or lines of light, produced by the flight of the sparks, and spark pictures, which are small explosions appearing along the spark rays. It is chiefly from the spark pictures that the percentage of carbon is estimated, since the brighter and more numerous the spark pictures, the higher the percentage of carbon. For example, in a 0.15 per cent carbon steel the spark pictures are small and few in number, whereas in a 0.5 per cent carbon steel the spark pictures are clustered together much more thickly and are bigger and brighter, as suggested in Fig. 6. Steel can be tested by this method in any condition, since the character of the spark-sheaf is not affected by the physical condition of the steel. It is possible by this method to test each piece by merely touching the grinding wheel with it in such a manner that the tubing is not rendered unserviceable.

A French Development in Tops

AN unusual type of top is one of the features of the automobiles produced by the Voisin Company. This firm having been a pioneer in the aviation movement, has paid a lot of attention to head resistance in the design of its cars, and has condemned the conventional type of top as responsible for a considerable waste of power. Their design cheapens production, reduces weight and improves the streamlining of the car.

On close-coupled four-seater semi-sporting type bodies the top is carried on a couple of steel tube T-members, the forward one of which is dropped into a socket immediately behind the front seats and the rear one in a similar socket back of the rear seats. At the base of the vertical member of the T is a notch which fits over a pin in the socket, thus preventing any tendency to turn. The canvas is entirely separate from the frame. The top and back are in one piece, and when not in use are folded up and kept in a suitable pocket, or under the rear seat cushion. When required as a protection, the canvas is fastened down at the rear by push buttons, carried over the two T-members and brought over the top of the wind screen frame. Attachment is made at the front by a stiffening bar running through the front edge of the canvas, and having its two ends fitting into eyes on the top of the windshield frame.

When not required, the vertical leg of the forward T-member drops into the corresponding leg of the rear T, and by means of short projecting pins on the lower face of the cross member of the forward T registering with holes on the rear T, the two supports become one unit. They are placed under the "deck" back of the front seats, and by means of a large-diameter knurled nut on the base of the stem are wedged in position between the floor and the underside of the deck. The top can be put up or taken down quickly and with little exertion. Construction is cheap, for the frame consists only of steel tubing with plated finish, with one end threaded to take a nut. Weight is certainly 50 per cent less than with an ordinary type top.



Details of the new Voisin top

French Aviation Appropriations

CIVILIAN aviation in France will receive during 1922 a total of 154,878,000 francs from the French Government, according to the budget estimate for the year which was recently made public. The largest item in the estimate is 84,405,000 francs for works, aerodromes, technical laboratories and meteorological services. Subsidies totaling 37,022,000 francs have been set aside for French companies, enabling them to share in transcontinental transportation. In 1921 the sum for this purpose was 27,885,000 francs.

Six new international air lines are to be established in France during this year. While it has not been definitely established as to where these lines will run, indications are that Bordeaux will become a port for the head of lines to Switzerland, Morocco, Spain, Italy and the Mediterranean routes, as well as a stop on the Paris-Lisbon (Portugal) route.

There is available in the Automotive Division of the Bureau of Foreign and Domestic Commerce a comprehensive report on "What the French Government is Doing for Commercial Aviation." It may be obtained by applying to the division for exhibit No. 49,220.

The Relation of Carburetion to Fuel Economy

Part I

The solution to the problem of fuel economy centers about that of proper carburetion. Mr. Golten states that existing carbureters and hotspot devices are inefficient and urges study of problem from a new angle.

By J. N. Golten

THE chief problems of the automotive engineering fraternity to-day are those relating to fuel economy. These problems are many, and they vary from the purely mechanical to the highly theoretical. Such considerations as increasing mechanical efficiency, decreasing gear ratio, etc., offer minor means of increasing car mileage, but the greatest latent possibilities center about the solutions of carburetion problems.

The statement has often been made that the fuel consumptions of our present day engines can and must be reduced, and numerous minor changes in engine design have been made with this end in view, most of them centering about the carbureting system. However, nothing really drastic has been undertaken, probably because there has not been sufficient co-ordinated knowledge of the essentials of proper carburetion.

The exposition that follows is intended to be a summing up of the conditions necessary to proper carburetion, in a modern engine, with modern fuels, and statements on the shortcomings of the carbureting means now ordinarily employed. It is the purpose of this article to present for the first time these various facts in their true relation to each other and the carburetion problem as a whole.

Functions of a Carbureting System

The ultimate aim of the carbureting system is to introduce into all the cylinders of an engine equal amounts of the most economically burning mixture. With this object in mind the three primary essentials of a correct carbureting system may be stated thus:

1—The metering of the most economical air-fuel mixture at all loads and speeds.

2—The uniform distribution of this mixture to all the cylinders.

3—The complete vaporization of all the fuel at the instant the spark passes in the cylinders.

These three essentials will be taken up in the order stated.

From time to time excellent articles have been published, tabulating the results of exhaustive tests made to determine the most economical mixture ratio for various speeds and loads,[1] but in spite of this fact the general knowledge of proper mixture proportioning for maximum economy is exceedingly hazy.

There is a widespread impression that a constant air-fuel mixture ratio of 15 or 16 is the most economical at all speeds and loads, but this idea is erroneous. Actually, at any given speed the mixture ratio for maximum economy varies from about 12 at no-load to about 17 at full-load. (These figures are for gasoline.)

Following are a few curves taken from P. S. Tice's article on "Carburetion Requirements of a Typical Gas Engine"[1] which may serve to make these points somewhat clearer.

These curves represent the variation of the brake specific consumption in pounds of fuel per brake horsepower hour, with variation in the air-fuel mixture proportion, (R), for several manifold pressures. A line drawn through the lowest points in each curve will give the variation in the mixture ratio of maximum economy with change in manifold pressure. This relation is represented by curve AB, Fig. 2, where R is plotted against absolute pressure in the manifold (H_a). The relationship shown by this curve is practically independent of speed. It is solely a function of the absolute pressure existing in the intake manifold.

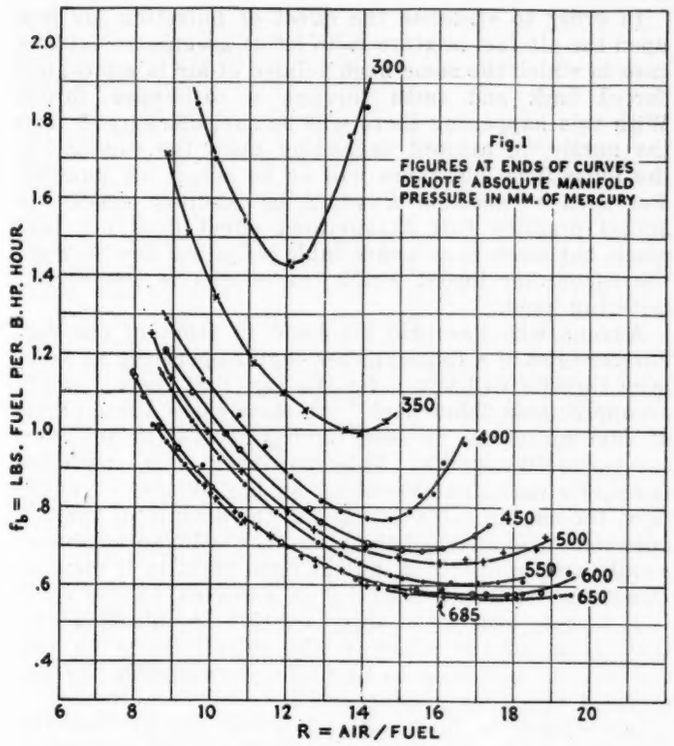
It will be noticed that at an absolute manifold pressure of 300 mm. of mercury, which corresponds to a car speed of from 15 to 18 m.p.h., a very small change on either side of the air-fuel ratio (R) corresponding to maximum economy results in a very large increase in the fuel consumption. As the manifold pressure increases a given variation in R accounts for a much smaller variation in fuel consumption. It is rather unfortunate that at manifold pressures which correspond to the normal running speeds of a car, comparatively small deviations from the most economical mixture ratio account for such large increases in the specific fuel consumption.

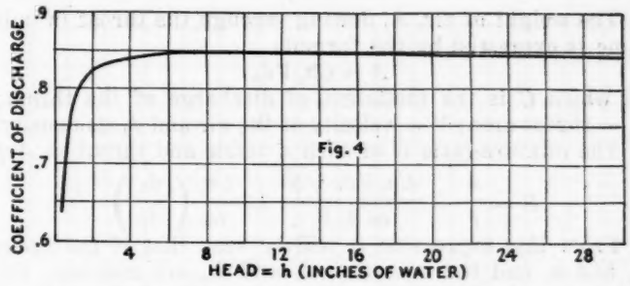
Metering Characteristics of an Ideal Carbureter

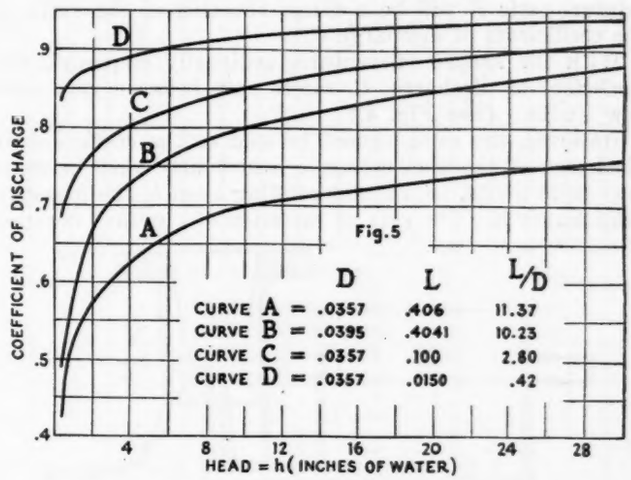
The ideal metering characteristics for a carbureter would be one in which R would vary with the manifold pressure according to the relationship shown in Fig. 2, curve AB, until nearly maximum manifold pressure was reached, and then R would change to the mixture ratio giving maximum power. As long as an increment of manifold pressure, meaning an increment of throttle opening, accounts for an increase in power, it is highly desirable to have the carbureter set so as to give maximum economy, but full throttle opening is only occasioned by a demand for maximum power, and this demand can only be satisfied by a reduction in R so as to get maximum engine output. Such a metering characteristic is shown in curve AC, Fig. 2.

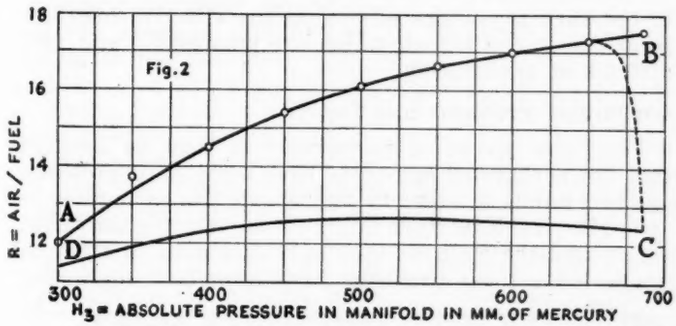
Repeated tests with gasoline as fuel have shown that a mixture-ratio of 12 to 13 will give maximum power independent of speed or load. Curve DC, Fig. 2, which is a

[1] See P. S. Tice's article, "Carburetion Requirements of a Typical Gas Engine" in *Automotive Industries* of June 24, 1920, and "The Carburetion of Gasoline," Purdue Engineering Experiment Station Bulletin No. 5, by O. C. Berry and C. S. Kegerreis.









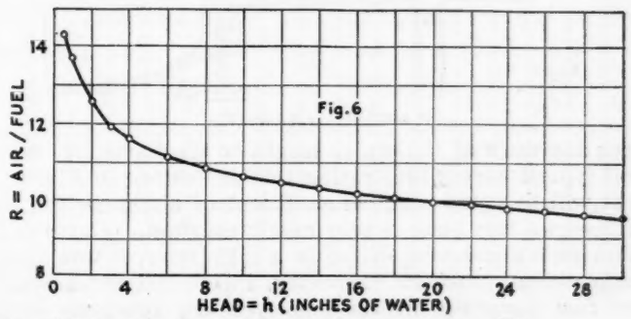


Fig. 1—Variation in specific fuel consumption with change in the mixture ratio, for various manifold pressures. Fig. 2—AB, curve of most economical mixture ratio with relation to engine load as represented by manifold pressure. AC, metering characteristic of an ideal carbureter. DC, mixture ratio of maximum power relative to engine load. Fig. 4—Variation in the coefficient of discharge of a typical carbureter venturi throat, with change in metering head. Fig. 5—Coefficients of discharge of carbureter metering orifices relative to pressure drop across these orifices. A comparison of curves A and B shows the effect of a change in orifice diameter upon the valve of the coefficient of discharge. A comparison of curves A, C and D shows the effect of a change in orifice length upon the value of the coefficient of discharge, and its rate of variation with change in head. Fig. 6—Metering characteristic of a simple carbureter incorporating a throat having a characteristic similar to the one shown in Fig. 4, and a metering orifice with a characteristic similar to curve B, Fig. 5

typical curve, illustrates this. It is plotted from the same data as other curves of Figs. 1 and 2.

It is often stated that present-day carbureters are almost perfect as metering devices, but actually the reverse is true. This statement may sound radical, but by analyzing the performance of a simple carbureter and then proceeding by steps to the present-day carbureter we may show in what respects the latter are faulty. Fig. 3 is a representation of such a structure. X is a constant level source of fuel supply for the nozzle Y which operates in the venturi throat Z. W is an adjusting needle used to vary the effective nozzle opening.

The force or metering head which causes fuel to be discharged at Y is expressed by the formula $K h = \frac{V^2}{2g}$ in which K is equal to the ratio of the density of the air passing through the throat to the density of the fuel $\left(\frac{d_a}{d_f}\right)$; h is included so that the metering head, or force which causes the fuel to flow can be expressed in inches of fuel; V = the velocity of the air through the throat; and g = acceleration of gravity = 32.2. The weight of fuel, f, discharged from the nozzle, Y, in unit time is expressed by the formula

$$f = ca\sqrt{2gh}\,d_f$$

However,

$$h = \frac{V^2}{2gK}$$

Substituting for h

$$f = \frac{ca\,d_f\,V}{\sqrt{K}}$$

in which c is the coefficient of discharge[2] of the nozzle jet; a is the area of the nozzle jet; and d_f = density of fuel; the other symbols having the same significance as in the previous expression.

For a given amount of air flowing through the throat in unit time f may be varied either by changing the size of the throat, and thus changing the velocity and metering head, or by changing a, the area of the nozzle. The latter means of adjustment is the ordinary one.

[2] The coefficient of discharge is the ratio of the effective area of an orifice to the actual area. Due to contraction of the stream flowing through an orifice, the effective area is always less than the actual area.

The weight of air, A, flowing through the throat in unit time is expressed by the formula

$$A = Ca_1 V d_a$$

in which C is the coefficient of discharge of the throat; a_1 = throat area; V = velocity of the air and d_a its density.

The mixture-ratio R of such a nozzle and throat = A/f

$$R = \frac{A}{f} = \frac{Ca_1 V d_a \sqrt{K}}{ca\, d_f V} = \frac{Ca_1}{ca}\left(\frac{d_a}{d_f}\right)^{1.5}$$

From this expression it will be seen that if the areas a_1 and a, and the densities, d_a and d_f, are constant, the mixture-ratio R will be a direct function of the ratio of the coefficients of discharge C/c.

With the shapes of venturis ordinarily employed, the coefficient of discharge, C, varies only between very narrow limits. (See Fig. 4.)

However, the same cannot be said of the coefficient of discharge of the fuel orifice, c, which may vary between very wide limits, its value depending upon h, the pressure drop across it. The rate of variation of c with h depends

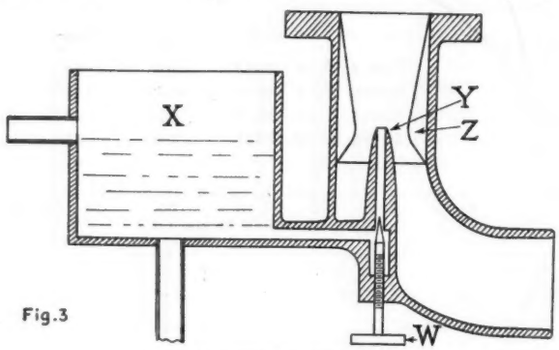


Fig.3 An elementary carbureter

upon the ratio of the orifice length to its diameter. Several typical curves illustrating this are shown in Fig. 5.

It will be noted that the coefficient of discharge for an orifice in a thin plate is very nearly constant. (Curve D.) With such a metering orifice in a carbureter, R would remain almost constant. However, in all carbureter work the fuel metering orifices employed are relatively long compared to their diameters, and this results in a metering characteristic in which R becomes smaller and smaller as A increases, when exactly the opposite effect is needed. Fig. 6 is a curve showing the variation in R with change in h, for a venturi with a constant C, and a fuel orifice with a coefficient varying according to curve B, Fig. 5.

There are other contributing factors which cause the mixture to become richer with an increase in A or h. In order to prevent dripping from the fuel nozzle when the carbureter is not in use, the fuel level in the float chamber must be maintained below the top of the nozzle. Thus a portion of the actual metering head, h, is employed in merely lifting the fuel and does not cause any flow. As A, and consequently h, is increased, the ratio of effective metering head to actual metering head is increased, resulting in the mixture becoming slightly richer.

Pulsating Air Flow

A very much more important factor and one of which very little is generally known is the increase of effective metering head due to pulsating air flow through the venturi throat. No matter what the direction of the air flow through the venturi, the throat pressure is always less than the pressure at either the upstream or downstream end, and consequently there will always be an effective metering head, causing fuel to flow independent of the direction of air flow through the throat.

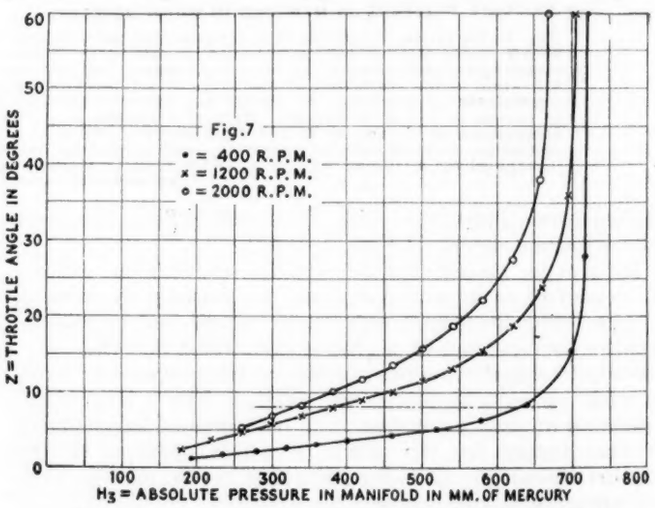
In order to visualize the effect of pulsating air flow upon the air-fuel mixture-ratio let us assume an extreme case in which the same fixed volume of air is alternately forced back and forth through a carbureter throat. With this happening there will be fuel discharged from the nozzle, in amount depending upon the rapidity of the pulsations, but there will be no actual air pumped. For such a condition R would be infinitely small. In actual practice this exaggerated effect does not take place, but there is an appreciable pulsating flow through the carbureter throat which contributes to the normal metering head.

Anyone who has held his hand in front of the carbureter inlet of a four-cylinder engine operating at wide-open throttle will vouch for the fact that there is quite an appreciable "blow-back." In some cases a fine plume of fuel spray can be seen issuing several inches from the carbureter mouth. This blow-back varies with the speed, its variation depending on the number of cylinders, the engine valve timing and the amount of throttle opening. The effect of the blow-back is inappreciable at small throttle openings, but at open throttle it may increase the metering head by as much as 65 per cent.[3] It is largely because of this variation in pulsating flow that a carbureter which works satisfactorily on one engine may be found to be entirely unsuitable for another of the same displacement.

In addition to these effects, bosses placed near the carbureter throat and the shape of the passages leading to the throat, produce effects on the effective metering head due to the throat, which are changeable and very difficult of explanation.

Carbureter Problems and Design

From the preceding paragraphs it may be deduced that the carbureter engineers have some hard problems on their hands in order to compensate the carbureter so as to give usable mixture ratios throughout the throttling range, and the methods they have employed in attempting to solve these problems have been both numerous,



Variation of absolute pressure in intake manifold with change in throttle position for several speeds.

and from the standpoint of maximum economy, ineffective.

Some small idea of the amount of work that has been done in order to develop a successful carbureter may be gathered from the comprehensive report on carbureters and carbureter patents written by Lucke,[4] in which he lists and classifies over 3400 different carbureters patented in the United States.

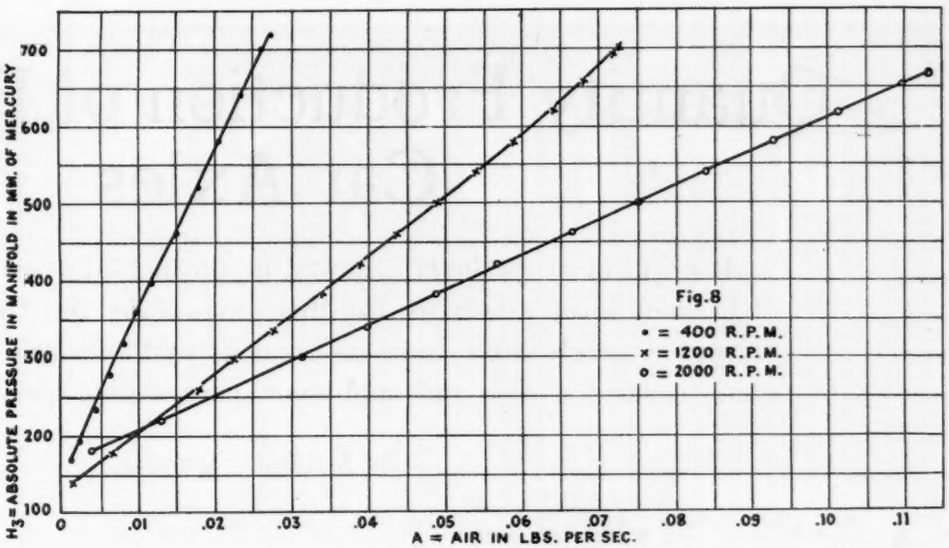
The means employed by these designers to secure

[3] This figure has been obtained by experiment on a 4.0 x 5.25-in. 4-cylinder truck engine.
[4] Second annual report of the N. A. C. A., 1916.

what they considered proper metering characteristics are both numerous and ingenious, but practically all of them have striven after the wrong goal. True, a few have met with some measure of commercial success, as witnessed by the carbureters on the market to-day, but they have all fallen far short of the ideal.

The auxiliary means employed to vary the mixture proportions on the better known carbureters of to-day consist of multiple nozzles, auxiliary air passages, cam operated needle valves, weighted valves, "air bleeds," etc., or combinations of these, but without exception the carbureters are so designed that the variations in mixture proportions depend upon the throttle position, or the quantity of air pumped by the engine, or both, whereas, as we have seen before, **variation in R should be solely dependent on the absolute pressure existing in the manifold.**

Figs. 7, 8 and 9 are curves showing the relationships existing between throttle angle, Z, air pumped by the engine, A, and the manifold pressure, H_3. An examination of these curves in connection with Fig. 2, in which is shown the variation in the mixture ratio of maximum economy with manifold pressure, will serve to explain the shortcomings just referred to.



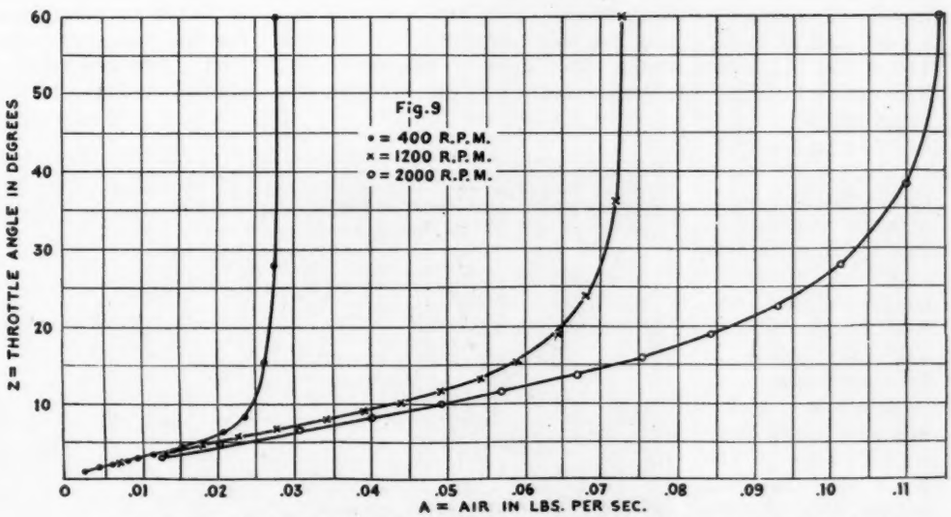


Fig. 8—Relation between absolute pressure in intake manifold and quantity of air pumped for several speeds

Fig. 9—Relation between throttle angle and amount of air pumped at several speeds

Following is an example of the errors in metering relationship introduced in a carbureter giving a constant R, or one in which compensation is attempted by any of the just named means. Let us assume a fixed throttle opening of 8 deg. Referring to Fig. 7, we find that at the several speeds shown H_3 is equal to 332, 385 and 630. Taking these values and referring to Fig. 2, we find that these several manifold pressures correspond to mixture ratios of 12.83, 14.19 and 17.20.

Thus, for these several speeds we find that for the best results we need widely different air-fuel ratios, whereas the conventional carbureter is designed to give but one. Therefore, at only one of an infinite number of speeds will the mixture from this carbureter be correctly proportioned at that particular throttle opening. The same reasoning holds true for all other throttle positions.

For those carbureters that depend upon the amount of air flowing for any extra variation in the metering head or fuel nozzle opening, there is a similar error. If we assume a fixed quantity of air and determine the corresponding manifold pressures and mixture ratios for the several speeds, there results a similar large range of mixture ratios, which indicates a corresponding error. Thus it may be positively stated that any and all carbureters that depend upon a change in air or throttle opening for a change in mixture proportions, can never be made to realize the mixture proportions of maximum economy at all loads and speeds, or even closely approximate these ratios.

Proper mixture proportioning is of absolutely no avail unless we have at the same time perfect distribution. The mixture ratios giving maximum economy are fairly close to the lean limits of combustibility; consequently, should one of the cylinders receive less than its share of the fuel the mixture in that cylinder will be so lean that it will either fail to ignite or burn so slowly as to provide very little power. In either case the result will be a ragged running engine. In order to avoid this condition of uneven running, the operator enriches the mixture so as to get the lean cylinder to fire regularly, and in so doing he provides an excess of fuel to the remaining cylinders with a resulting loss in economy. This catering to a lean cylinder or cylinders is experienced in almost all engines.

All that has been said in the foregoing paragraphs on metering has implied the condition of perfect distribution, but, sad to relate, with our present carbureting systems and modern fuels, this condition is never obtained because of the presence of liquid fuel in the inlet manifold.

(To be continued.)

Quantity Production of Passenger Car Axles

A description of methods followed in the manufacture of axle housings at a plant built especially for this purpose by the General Motors Co. Output is nearly three times as great as that formerly possible with the same number of men and same floor space, due to special tool equipment.

By J. Edward Schipper

A NUMBER of the axles for General Motors cars, including Oldsmobile, Oakland and others, are being made in the new axle plant which adjoins the Oldsmobile factory at Lansing, Mich. This building was designed and built especially for this purpose. It measures 140 x 750 ft., giving a total floor area of 105,000 sq. ft. The entire building has been designed to put through the axles rapidly in a progressive manner so that the flow of material is constantly in one direction from the point at which it enters as raw stock to that at which it leaves as completed axles. Both front and rear axles are made in this building.

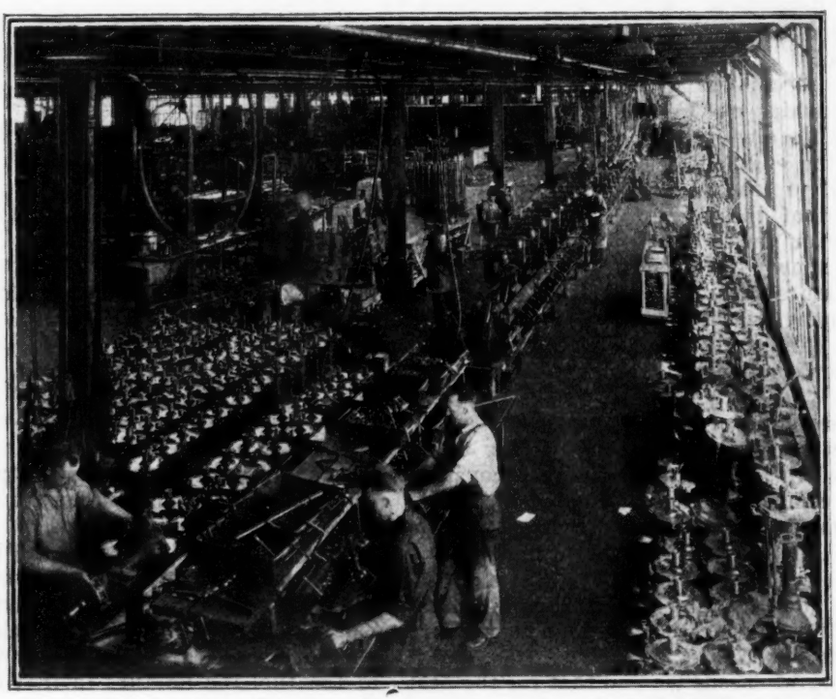


Fig. 1—Portion of Oldsmobile axle shop, showing part of the assembly line in the foreground

Arrangements have been provided in the way of traveling cranes with electric magnets for unloading the incoming stock and loading the outgoing axles. The equipment at the present time consists of sufficient machinery to manufacture 400 front and 400 rear axles per day. The building is so designed that it allows latitude for expansion. Additional machinery can be installed to double present capacity. In the manufacture of the rear axles, the majority of the machining work is, of course, required on the housing. The axle tube, axle shaft and other units are relatively simple and can readily be handled by stock machines. However, a great deal of special machine equipment which is very interesting from the standpoint of economy of space, as well as rapidity in manufacture, is used in the production of the axle housing. An idea of the plant layout is given in Fig. 1.

The machine operations not only on the housing, but also on the axle shaft and tubes, takes place at one end of the building and partially along the rear axle assembly line, so that the finished parts are brought to the assembly department at a point where they can be applied to the assembly without requiring intermediate stocking in finish or semi-finish stock rooms. Malleable castings for the housings come in from outside and are in three parts; left and right differential housings and the pinion shaft housing. It will be remembered that the Oldsmobile has a torque tube arrangement on the rear axle, the pinion housing taking the differential housing at the rear end and the torque tube, which incloses the propeller shaft, at the front end.

Malleable housings for the differential and drive gearcase require different machine operations on the left and right sides owing to slightly different shapes, and the fact that one of them has to be drilled for oil filler and drain holes. These two housings are bell-shaped, the large ends being joined in assembly and the smaller ends being bored to take the tubes which surround the axle shaft.

The left differential housing is almost entirely machined in a remarkable special machine, Figs. 2 and 3, which is the design of the Defiance Machine Works. It is a two-way automatic, which performs a complete series of operations. The work is located on a floating sleeve with three floating pins which butt against the work in the center, and another floating pin which passes between the bosses for the brake camshaft holes. The work is fixed in position by a floating center clamp and is driven by two set-screws. The machine is capable of 45 pieces per hr., but owing to the fact that hard castings have been encountered recently, the speed has been cut down to 33 per hr.

There are ten operations altogether on this machine,

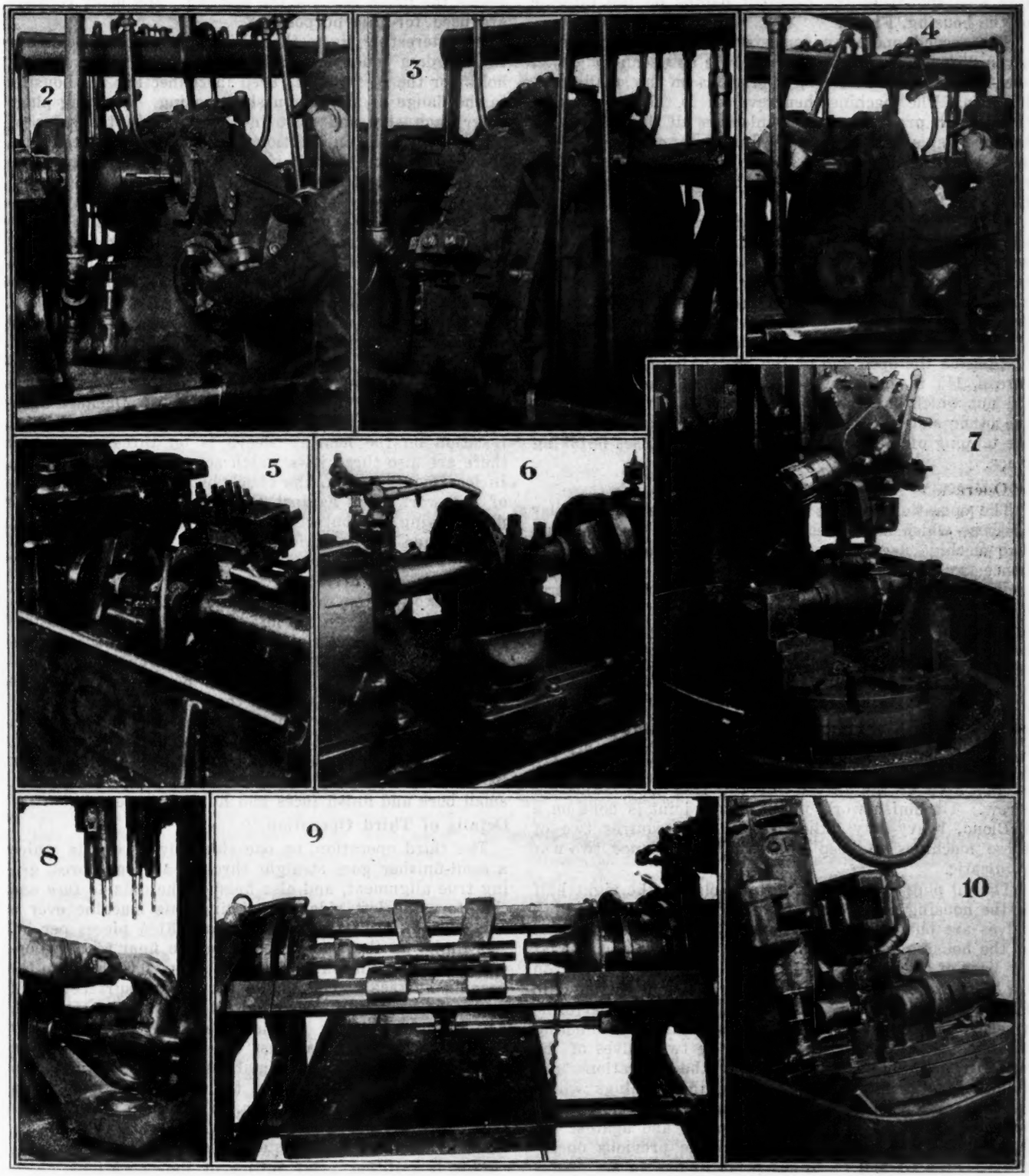


Fig. 2—Operations on the malleable differential and drive gear housing on the Defiance special, two-way automatic. This illustration gives an idea of the chucking and location of the work, as well as the way in which the three internal diameters are handled simultaneously on the left side of the machine. Fig. 3—Operations on the rear axle center housing on the right side of the Defiance two-way special automatic. The operations on the right and left sides of the machine are carried on simultaneously. Fig. 4—Defiance two-way special automatic used for the pinion shaft housing. This is a similar machine to that used for the central housing. Fig. 5—Roughing flange joints at the center of the rear axle housing on Fay automatic. Fig. 6—The finish work on the flange joint is done on LeBlond heavy duty lathes, of which there are two. Fig. 7—Finishing the outside of the housing on a semi-automatic Gisholt boring mill. These machines perform six operations at a speed of 1000 pieces per 9 hr. day. Fig. 8—Interesting jig method for locating the work on the Gardam multiple spindle drill for the six 3/8 in. stud holes in the flange of pinion shaft housing. Fig. 9—Pressing in the axle tubes on an Eastern air press. Fig. 10—Sawing the bearing clamp slots in the pinion housing on an Ohio tilted rotary miller.

some of which are compound, so that the number really runs up to considerable more than this. The operations are indexed automatically. The first is a rough boring operation both on the left and right side, the small rougher going into the small end of the housing, Fig. 3, and the large rougher into the bell opening. This opera-

tion also spot-faces the different depths on the interior of the housing, Fig. 2.

The second operation consists of boring a cluster of seven 25/64 in. holes on the open side and semi-roughing, spot-facing and chamfering operations on the small opening also. The machine then revolves to the third operation, which produces a semi-finish on all three bores on the open side and includes a finishing operation on the depths on the open end. At the same time centers are made for the two holes for the brake camshaft and the bosses on the small side.

In the next index position a finish reaming of the open end for all three bores is accomplished. This is done with a sectional reamer which reams three surfaces simultaneously. On the other side, the 5/16 in. holes and the bosses which were centered on the previous operation are drilled.

The next and final operation on this machine is the tapping on the open end of the 3⅜ in. bore for a sixteen thread, 1¼ in. deep. This is the thread for the adjusting nut which governs the position of the ring gear. On the other side of the machine, simultaneously with this, the tapping of the two ⅜ in. holes in the bosses is taking place.

Operations on Right Housing

The operations on the right housing are very similar to those which have been described on the left housing. The machine used is also similar, being one of the Defiance two-way automatic lathes which was designed specially for the General Motors Co. and with their co-operation for this work. The location is from a floating sleeve and the work is held in place by a floating chuck clamp as in the other case. The drive is through two set screws which hold the work firmly in both directions.

Following the work on the Defiance automatic, the housings are put through a Fay automatic, Fig. 5, which roughs the flange joints at the center of the rear axle housing where the two bell openings of the left and right side go together. This work is located from the shoulder at the base of the thread for the ring gear adjusting screw. The finish work on the flange joint is done on a LeBlond, heavy-duty lathe, Fig. 6. It requires two of these machines to keep up with the Defiance two-way automatic.

The oil plug holes and oil drain holes in the right half of the housing are drilled on a Fosdick drill press. Both halves are put on a LeBlond machine to face off the end of the housing to an exact distance from the shoulder at the base of the thread. This is solely a locating operation for the next cut which is taken on a Gisholl boring mill, Fig. 7. This is a semi-automatic machine which performs a series of interesting operations, substantially finishing the housing. In these operations, the two halves of the housing are bolted together and the operations are mainly for the purpose of forming the openings which take the pinion housing and finishing the exterior of the housing. Location is from the shoulder and against the face, which was finished exactly in the previous operation. These Gisholl machines perform five to six operations at a speed of 1000 pieces every 9 hr. per machine. It is claimed that to duplicate the amount of work on individual drills would require the installation of at least a dozen ordinary type machines and the employment of eight additional workmen. Furthermore, it would be difficult to hold the same precision of which this heavy machine is capable.

The first operation is to rough face the housing; second, to rough bore the inside and outside diameters. The third operation semi-finishes the inside and finishes the outside. The fourth operation finish faces and chamfers the inside of the housing, and the final operation reams the finish hole for the housing. McClusky reamers are used for this purpose.

An interesting jig method, Fig. 8, is used to locate for the Gardam multiple-spindle drill, which drills the six holes for the ⅜ in. studs used in connecting the housing to the flange of the pinion shaft casing. Locating plugs enter each side and pilot in the bores in the sides of the housing, and, in addition, the housing is piloted on a dowel in the pinion shaft bore with the drilling operation performed around this dowel.

Before assembly, the threads for the ring gear adjusting screw are re-tapped by hand to insure their accuracy. This is done on both the right and left hand housing. The axle tubes are pressed in position on an Eastern air press, Fig. 9, this being a very close press fit. After being pressed in, the tubes are riveted in place. The tubes are all machined on automatics and are ground on the wheel bearing end prior to assembly.

The operations on the pinion shaft housing are performed in very much the same way as those on the right and left halves of the central housing. A Defiance automatic two-way lathe is used for this work also, Fig. 4. Location on the floating sleeve is on three points and there are also three jaws which act as a universal chuck. In locating the work, the chuck brings the inside flange of the work back against the chuck, the inside of the flange being in contact with the outside of the chuck. The outside of the pinion housing is ribbed and one of the ribs is taken between two jaws in the floating collar which acts as a driver.

The two-way operations on the Defiance machine are as follows: First, on the left side a large rougher enters the bore, and on the right, a small rougher machines another bore. On the left side, the tool roughs out three diameters on the interior of the housing, and on the right side, one diameter. On the right side there is also a spot-facing operation on the end of the housing and a 45 deg. chamfer. The machine then indexes for the next operation. On the left side are drilled six 15/32 in. flange holes. On the right side a tool semi-roughs the small bore and finish faces and finish chamfers it.

Details of Third Operation

The third operation, on one side only, is one in which a semi-finisher goes straight through all four bores, giving true alignment, and also finishes the outside face and chamfers the left side. In timing this machine over a long period, it was found to average 31½ pieces per hr. The limits on the four bores after the final reaming operations on this machine are as follows: 0.0008 in. on the bearing surface; 0.002 in. on the thread surface; 0.001 in. on the adjusting sleeve and 0.002 in. on the tube end. A Warner & Swasey finishes the exterior, particularly the face which goes against the gear housing, and an Ohio tilted rotary miller, Fig. 10, saws the bearing clamp slot. In the latter operation, the work is piloted on its bore over an arbor for location. The pinion housings are spot-faced and drilled and then passed along the assembly line. A progressive system assembly is used.

This is a rather brief outline of the operations which take place in the manufacture of the rear axles. Nothing has been said in this regarding the heat treating department, which is an important unit in this manufacture. Heat treating is used for such parts as the axle shafts and pinion shafts, and heat treating operations are given after the bulk of the machining work is done so that the duty on the cutting tool is as light as possible. The outstanding feature of the axle department is the fact that 800 sets of axles can be manufactured in a day, while with older methods, with the same space and number of men, the plant would hardly have produced a third of that amount.

The Relation of Vehicle Speed to Highway Damage

There is a definite relation between the speed of a motor vehicle and the wearing effect upon the highway. This articles gives the results of some interesting tests that have recently been made to determine this relation. Increased speed of solid tired vehicles increases the impact in far greater proportion than it does in the case of pneumatic tired vehicles.

By W. G. Robertson*

SPEED, for the purpose of this discussion, will be taken in the sense—rate of travel or velocity rather than in the sense—to make haste, perhaps unnecessarily.

It is well known that speed is a very important factor in the amount of destruction which results from the unrestricted use of the roads by vehicles. The impact increases very rapidly with increase of speed. It increases much more rapidly in the case of a truck equipped with solid tires than one equipped with pneumatic tires, because of the greater resilient qualities of pneumatic tires.

A report issued by the United States Bureau of Public Roads on the "Effect of Impact on Pavements" gives some interesting information on this subject, and shows that the impact resistance increases with the velocity, with the total weight of the vehicle, and with increasing road-surface roughness. In these tests, the impact resistance of good asphalt or bitulithic or other smooth pavement, was practically negligible, and reached its highest values on granite-block roads with sand-filled joints, and on badly worn macadam pavements. The rate of increase of impact resistance with speed was most marked on the roughest roads.

The following urban pavements are enumerated in the order of their desirability for vehicle operation from the point of view of tractive resistance at 20 km. (12.4 miles) per hour, as found in this investigation. (1) asphalt, (2) wood block, (3) hard, smooth macadam, (4) brick block, (5) granite block with cement-filled joints, (6) cinder, (7) gravel, (8) granite block with sand-filled joints.

The equivalent grade at 20 km. (12.4 miles) per hour of a badly worn city macadam road was found to be nearly three times as great as that of the best asphalt road tested. This means, at this speed, a consumption of energy at wheel treads of nearly three times as much on level macadam roads as on good level asphalt roads.

Increasing the gross weight of the vehicle by 12 per cent. through load was found to have no effect on tractive resistance within the observed speed limits for smooth roads in good condition; but on rough roads, a distinct increase in tractive resistance with this extra weight was observed.

Tests have been made which show that increased speed of a vehicle equipped with hard rubber tires tremendously increases the impact which its wheels make on the roadway where there is any unevenness. On the other hand, where pneumatic tires are used, increased speed adds comparatively little to the impact. It has been suggested that these tests will be of great value not only in settling questions of design, but may also lead to a rational basis for determining license fees for motor vehicles.

Trucks have been used in these tests varying in size from a 1-ton up to a 7½-ton truck, carrying an excess load. Each truck was run over a special recording device imbedded in the roadway and the impact which resulted, when one of the wheels made a two-inch drop from a ledge built in the surface, was recorded.

Recent tests were made with a 3-ton truck loaded so that the weight on each rear wheel was 7000 lb., the unsprung portion being 1700 and the sprung portion 5300 lb. The truck was equipped first with an old solid tire that was worn down to a thickness of one inch. Then, with exactly the same load on the truck, a wheel was fitted with a new solid tire 2½ inches in thickness. And finally the truck was equipped with pneumatic tires, 42 x 9 in., blown up to a pressure of 142 lb. per square inch. The following table shows very clearly the bad effect an old tire is likely to have on a road surface and the greatly lessened impact which is produced by trucks equipped with pneumatic tires. The tests show that as the vehicle's speed was increased, the impact from the old hard rubber tire increased greatly. The impact from the new tire was somewhat less.

Speed	Old Tire	New Tire	Pneumatic Tire
5.7 miles	11,600 lb.	9,400 lb.	7,100 lb.
10.2 miles	18,500 lb.	14,100 lb.	7,900 lb.
14.6 miles	26,500 lb.	18,700 lb.	8,330 lb.

In fixing speed limits for motor vehicles, legislators hitherto have given consideration mainly to the question of safety. Diversity of opinion as to what constitutes a safe maximum speed is reflected in the variety of legislation on this subject in different provinces and states. The State of Kansas sets 40 miles per hour as the upper limit of speed in the open country. California and a number of other states draw the line at 35 miles per hour, while 30 miles per hour is about the average for all the states.

Thirty miles per hour is the maximum speed limit in British Columbia, while the other western provinces fix no limit other than requiring speed at all times to be reasonable, having regard to traffic. In Ontario, Quebec

*An address delivered at the annual convention of the Ontario Good Roads Association. Mr. Robertson is secretary-treasurer of the Ontario Motor League.

and Nova Scotia the upper limit has been fixed at 25 miles per hour. New Brunswick sets no definite speed limit other than what is reasonable, having regard to traffic, while Prince Edward Island, but recently opened up to the automobile, puts the ban on a speed in excess of 15 miles per hour.

In this Province the Load of Vehicles Act (Section 5) stipulates that no vehicle carrying a weight in excess of four tons, including the vehicle, shall be operated on any highway at a speed greater than 10 miles an hour; and no vehicle carrying a weight in excess of six tons, including the vehicle, shall be operated upon any highway at a speed greater than 8 miles an hour.

The speed limits for trucks provided in the Ontario act are extremely restrictive. If modified in conformity with recent experience, all commercial vehicles equipped all around with pneumatic tires would be restricted to 25 miles per hour on open country highways, while commercial vehicles equipped partially or all around with solid tires would be required to conform to the following speed schedules:

Gross Weight	Open Country Highways
Under 2 tons	25 miles per hr.
2 to 6 tons	20 miles per hr.
6 to 10 tons	15 miles per hr.
10 to 14 tons	12 miles per hr.

To fix the speed limit of commercial vehicles at an extremely low figure means also interference with the free movement of general traffic on the highways. On a road of average width, when there is a steady stream of traffic in opposite directions, it is at once both difficult and dangerous to pass a succession of slow-moving vehicles in the face of oncoming traffic.

The great increase in motor truck traffic, indeed, points to an early necessity of providing such width on main highways as will enable trucks and slow-moving vehicles to travel the outside of the road and leave a lane of sufficient width for two lines of the more swiftly moving passenger cars. Under present conditions it is just a question whether it might not be conducive to safety to require all motor vehicles to travel at not less than a minimum rate of, say, 12 miles per hour under normal traffic conditions.

Width of highways, degrees of grades and curves, nature of road intersections, ditches, and railway crossings, and volume and kind of traffic are all factors which must be considered in determining speed from the standpoint of safety. So complex are these factors that it is impossible to state what might be considered a reasonable speed on any but a straightaway stretch of country road without taking into account local conditions. Vigilance and sound judgment are essential to safe driving everywhere, and no arbitrary speed limits can be devised which will relieve the drivers of motor vehicles from the ever-present obligation of giving due regard to constantly changing traffic and road conditions.

Peru Offers Possibilities for Truck Sales

PRODUCTS of most of the leading truck manufacturers in the United States are found in Peru, as well as many European trucks. No one make of truck, however, with the exception of a well-known light truck, is found in any great number, though four or five makes of heavier trucks have each a respectable following.

The large number of different makes of trucks is probably due to the fact that consumers or users imported direct from manufacturers, rather than buying from local agents. The amount thus saved in the purchase price was probably offset by extra investment in spare parts, or by having the truck laid up for lack of them. Perhaps both.

There are three prominent fields for the motor truck in Peru. The first is in transporting merchandise from the coast to the commercial centers located a short distance from the seaboard. The leading trade centers of the coastal region of Peru are not situated right on the ocean, but a few miles inland. Lima is some nine miles (12 kilometers) distant from her port Callao. To the north of Lima, Piura is found a few miles from the port of Paita; Chiclayo offers a double opportunity to truck manufacturers, being a few miles from two ports, Eten and Pimentel; Trujillo follows suit, being a short distance from the port of Salaverry. To the south of Peru it is the same story. Cañete is a short distance from the port of Cerro Azul; Chincha Alta from Tamo de Mora; Ica from Pisco; and Moquequa from Ilo. Despite the fact that railways connect all the coastal commercial centers with their ports, there is a field for the motor truck. This is shown by the fact that trucks are now doing service between Lima and Callao against three forms of competition: mule-drawn carts, steam and electric railway. Further advantages to the truck will soon be evident for the highway for freight traffic between Lima and Callao is to be improved.

A more ambitious project than the linking of the coastal commercial centers with their ports would be a belt line of trucks joining up the different commercial centers one with another. This doubtless will come in time, for now automobiles are coming to Lima from outlying cities, such as Pisco, and there is a light truck service, perhaps irregular, between the capital and Cañete.

The second field for the motor truck is found on the haciendas or ranches of Peru, which are immense centers of agricultural activity like our western ranches or Southern plantations. From the haciendas the trucks can bring the cotton, sugar and rice to the commercial or trade centers, to be transported to the seaboard.

The third field is in the mines. Although the mining companies now have trucks, American manufacturers should see that they have more and better trucks. This should be easily accomplished, for most of the mining companies have home offices in the United States, and the manufacturer has neither a trip abroad nor foreign credit to consider. Here is export trade on his own doorstep.

At the present time the American motor truck is far in the lead in Peru, and in the field of the light truck bids fair to maintain it. In the heavier truck the European seems to be making more headway for the moment, due, perhaps, to the more favorable continental rate of exchange.

As to the type of truck suitable for Peru, without going into detail, it may be said that it should be a good truck, of the best material and well built; for only such a truck will stand the hard conditions of service in Peru. And any truck sent should be amply supplied with spare parts.

Just why the commercial centers of the coastal region were stuck a few miles back from the sea is not clear. It was probably for protection against the enemy. Be that as it may, it has resulted in putting all of them within truck shot of the coast. Let the American manufacturer plant his trucks on these sites, ready not to destroy but deliver any merchandise that may approach.

The Automobile in Brazil

Editor, AUTOMOTIVE INDUSTRIES:

Twelve years ago the poor pavement of Brazilian streets and the impassable roads of country districts made traveling by automobile in this country an almost impossible task. At the present time, from Amazonas to Sertão in Matto Grosso, from Minas Geraes to Rio Grande do Sul our country is covered with beautiful roads of the modern type. In the State of Sao Paulo the "Better Road Movement" has taken unusual progress since the present governor, Hon. Washington Luiz Pereira de Souza, was appointed to office. The Hon. Pereira de Souza is personally a great motorist, and one of the first steps he took after being elected was to use his influence in having the municipal governments of the leading cities within the state to appropriate sufficient funds for the construction of new roads and the upkeep and improvement of the old ones. During the first two years of his administration great headway has been made in road construction and improvement. In addition to numerous smaller roads, his administration should be credited with the remarkable Sao Paulo-Campinas road, 105 kilometers long. The State of Paraná has likewise an enterprising governor who has successfully promoted road construction within his state. Notable examples of newly built roads in Paraná are the 800-kilometer road from Ponta Grossa to Iguassu and others of shorter distances.

As a matter of fact, in all Brazilian states there is to-day an evident desire for better roads. This desire varies in intensity, it being dependent upon local wealth and natural resources. Nearly 150 kilometers of the interstate road from Rio de Janeiro to Sao Paulo have already been completed. Funds for this interstate road are provided by the Federal Government and the state government of Sao Paulo.

Roads, of course, have made it possible to introduce the modern automobile in our country. And among the cars used the American is found in larger numbers than those of European makes. We can state with emphatic assurance that public officials, as well as our leading plantation owners and farmers, merchants, etc., throughout our country, are beginning to realize the fact that automobiles, motor trucks and tractors are indispensable means of transportation and agricultural and industrial progress. Cars are to-day used for practically the same purposes that horse carriages and animal-drawn vehicles were employed years ago. Notwithstanding this remarkable progress in automotive vehicles, Brazil is in its infancy as yet when we consider the fact that three, four or more times the number of present cars could be used throughout the country.

In spite of the commercial depressions, past and present, the automobile trade is one of the most solidly built activities of our local trade. In no city has the popularity and use of the automobile decreased. Taxi companies are prosperous. The people have come to look upon the taxi with the same regard as street cars. It has even taken the place of the horse and the omnibus; taking the place of railroads, has solved the long-distance transportation.

The future of the automobile in this country is in the hands of those manufacturers who will strive for producing better cars and giving Brazilian importers and dealers better service and facilities. At the present time the American car is supreme in our markets; but this supremacy is likely to be lost to American manufacturers if they fail to make special efforts now to retain it. It will not take a great effort on the part of German manufacturers to compete with the Americans. Our exchange on the German mark is far more favorable than on the American dollar. There is always the possibility of German manufacturers coming to this country, looking up local requirements and going back home to build cars in just the manner that our buyers like to have them built and delivered. Germany just now is working hard to introduce her latest models. German manufacturers are looking for big business, and we believe that, with the advantage of the mark exchange in our favor, they will have no difficulty in introducing again their products. Of course, we must always bear in mind that American manufacturers are more advantageously equipped for the business, when we consider this advantage from the viewpoint of repair parts and mechanical equipments for car servicing and repairing. The handsome body styles and mechanical improvements are also to their advantage.

Our state of Sao Paulo should be considered as being the "leader" in our country in connection with automotive activities. Our state has to its credit a larger road mileage, and 15 large concerns devoted exclusively to the importation, sale and service of automotive products. These concerns handle American cars almost exclusively, in addition to tires, accessories, etc., of American makes. They handle about 50 per cent of the total automotive trade of Brazil. In view of these facts, American manufacturers should turn their attention to our state.

Among the most important things that American manufacturers should look into are the following:

(A)—Protection to representation granted to Brazilian firms or individuals. Agencies should be established on permanent and sure basis, so that agents or representatives will handle it properly through personal interest in the business. Manufacturers should not change representatives as frequently as they have done in the near past.

(B)—To comply with all requirements or specifications indicated in our orders, in connection with finish, color, type of rim or wheel, magneto ignition and others of similar tenor. Most manufacturers disregard these instructions.

In spite of the existing depression weighing upon our markets and which reflects against American-made goods, since the exchange on the dollar is exceedingly high, and curtails importations from the United States, the automobile business has not suffered as much as other lines of activities. It is true that sales have fallen off when compared with normal market, but, however

reduced, there has been a steady stream of orders, and we can say that, all things considered, this has been a fairly good business.

The prospects are brighter for the 1922 season. Brazil will commemorate this year her independence centenary. Those of optimistic mind are hopeful that this occasion will mark the rehabilitation of the exchange with the United States. At any rate, we all hope the coming year will witness an era of rehabilitation and readjustment of our economical life which will mean higher local production and more money in circulation.

Let me now make some brief remarks as to what I consider wise for American manufacturers to do during the present period in order to retain and improve their business and relationship with Brazilian automotive importers and dealers:

(1)—To establish commercial relationship with reliable native firms or individuals. To send traveling representatives to become thoroughly familiar with Brazilian markets, selecting for this purpose men of good manners and of wide experience in international trade able to speak our language and acquainted with our mode of living. Preference should be given to those having technical knowledge of methods and equipments for servicing and repairing automotive products.

(2)—Manufacturers should endeavor, as far as feasible, to give their representatives or important clients long credits. This policy will be found very advantageous in connection with tires, repair parts and accessories, as local buyers usually buy these goods on terms.

(3)—To give more attention to the matter of service to owners, through reducing the price of spare parts. During the past months these have been sold at fantastic prices. Also special attention should be given through manuals or other forms of printed matter, to repair and maintenance methods.

Should American manufacturers follow these leads as closely as possible it will not be surprising to see, say in the course of ten years, that all cars in Brazil are American-made cars. Let me also state the fact that American manufacturers will never find a better market for their cars than our country. Automotive development is here in its infancy. The automobile is just beginning to make headway under the right character of a vehicle of practical utility rather than a conveyance for the wealthy and exclusive.

I write authoritatively on these matters because I have had many years' experience in this line in my native land.

FLORIANO P. SANTOS,
Sao Paulo, Brazil.

Air Cleaners

Editor, AUTOMOTIVE INDUSTRIES:

Referring to your editorial in the Jan. 26 issue on the subject of air cleaners for road vehicle engines, it is unquestionably desirable to employ an air cleaner and particularly on truck engines.

Reference is made to the objection to the use on high speed engines of air cleaners of the type which offers high resistance of the passage of air. An air cleaner of the so-called filter type, while being the most satisfactory from the standpoint of efficiency, fails to function consistently where an excessive amount of dust is handled for the reason that while they can be made self-cleaning, they will not work under severe conditions and quickly become clogged. In this respect, has sufficient attention been paid to the location of the air intake so that the amount of dust the cleaner has to handle is minimized?

In almost every instance, the location of the air inlet is inside the hood, subject to all the dust that is drawn in by the fan through the radiator. It is evident that this location is most unfavorable, and tests have indicated that if the air were taken from the driver's compartment, for instance, the amount of dust taken through the cleaner would be reduced by 60 per cent. Under these conditions, a filter type of cleaner of the simplest type can be effectually used.

NORTHWAY MOTOR & MFG. CO.,
Div'n General Motors Corp.,
A. A. Bull, Chief Engineer.

The Vaporization of Motor Fuel

Editor, AUTOMOTIVE INDUSTRIES:

I noted with some surprise your article in the AUTOMOTIVE INDUSTRIES, page 509, of March 2, 1922, headed "A System for Complete Fuel Gasification." I refer particularly to your statement that it is necessary to raise the mixture for the average American gasoline to a temperature of about 425 deg. Fahr.

Your article would lead one to believe that in order to completely vaporize gasoline, the temperatures that must be maintained are fixed only by the end points of the fuels used.

There has been so long a misunderstanding in the automotive industry on the subject of the scientific use of motor fuel, I feel inclined to call your attention to this erroneous statement. It seems to be a recent discovery to automotive engineers that a fundamental scientific fact respecting materials existing in combination is that their characteristics are affected by their environment. Physical chemistry has so long dealt with partial pressures, and the laws of mass action, now fundamental to all chemistry, are so entirely based upon partial pressure, it seems a reflection on the intelligence of technical men to have to refer to the subject.

About a year and a half ago, one of the technical associates of the Deppe Company wrote Dr. Cottrell, then Director of the Bureau of Mines, and called his attention to the fact that the specifications for motor fuel were to be based entirely upon the distillation points under atmospheric pressure, which was wholly misleading, as the fuel was never utilized in that manner. Partial pressures of the fuel, when dealt with in the presence of other matter, have been quite generally overlooked in the automotive industry and yet are fundamental principles of chemistry and physics. It is unfortunate that terms having a definite meaning in science frequently have another meaning in industry. To such an extent has this become prevalent that it is necessary to define the meaning to prevent misinterpretation. Thus, evaporation in chemistry and physics is known as slow vaporization. Evaporation to dryness, for instance, has a very definite meaning in the chemical laboratory. In engineering practice, evaporation, instead of being applied to a slow rate of vaporization is applied to the most rapid rate of ebullition which is practiced in the arts. The performance of a steam boiler is always specified in evaporation per pound of coal or the rate of evaporation per hour and the standard definition of horsepower is technically so specified. Another term having a definite physical and chemical meaning, "vapor tension," has long been used by the Government and the Interstate Commerce Commission to define the allowable pressure permitted on gasoline tank cars. In other words, "vapor tension" has been used under Government sanction for total pressure. It is only recently that a joint committee has pointed out that from the scientific point of view this is not vapor tension. *The term, however, has not been changed.* In selecting a term to be applied in the arts, therefore, its use in such arts must be taken into consideration and not its use alone in the physical or chemical laboratory. Thus it is with "boiling point." There is really no fixed boiling point, the

boiling point being dependent entirely upon the conditions to which the liquid is subjected, each pressure having a different boiling point. By agreement, the standard boiling point of water is taken under standard atmospheric barometric pressure, namely, 100 deg. Cent., at 760 mm. pressure. This standard, therefore, defines these conditions only and does not in any manner attempt to define or limit the fact that there are other boiling points. These boiling points are commonly taken for materials in the liquid mass and not in an atomized or spherical condition. A globule of water dancing on a red hot plate is an illustration of the phenomenon known as "false equilibrium." In this case, the surface tension of the globule has now disturbed the boiling point and the globule no longer boils at normal temperature. Therefore in selecting a term to define under what conditions a liquid may be converted into a gaseous state, consideration must be given to conditions other than temperature and pressure. One is at once confronted with the fact that mechanical sub-division may alter the boiling point independently of the temperature or pressure of its environment and that where liquids are used in mechanical sub-division such as an atomized condition, certain laws relating to the boiling point in the mass no longer hold. In other words, colloidal chemistry is an accepted principle of physical chemistry and has laws that are immutable. It is possible to boil water at 32 deg. Fahr. by reducing the pressure low enough. It is possible to run this temperature up to the decomposition point of water without boiling it if the pressure on the liquid is high enough. Temperature alone means nothing in specifying the boiling points of liquids.

We have read with great interest Mr. Howard's very able paper in which he endeavored to determine the pressures and temperatures at which vaporization takes place, but any application tending to interpret that subsequent condensation cannot take place under changing temperature or pressure is not in accordance with physical laws. Likewise of interest were the very able and ingenious methods proposed by Professor Wilson for determining what he calls an "equilibrium solution," but we have watched in vain for some technologist to ask why the end point of his equilibrium solution became 482 deg. Fahr. whereas his original gasoline had an end point of 410 deg. Fahr. This brings one into a complicated field of physical chemistry but it is so pertinent to the hot spot applications that I cannot refrain from commenting on it. In other words, in applying heat to cracked gasolines, it will be found they are tremendously susceptible to polymerization, and singularly enough while the automotive industry as a whole criticizes the heavier fractions of the fuel, as these have already polymerized, they do not in general have the same tendency to polymerize as some of the lighter fractions which have been temporarily hydrogenated. The subject of hydrogenation has attracted much attention in the past three or four years and is the next debutante to the automotive society. In cracking heavy fuels to produce light motor fuels, if it is desired to produce a high content of saturated hydrocarbons, probably hydrogenation must be resorted to, the question of whether the hydrocarbons are saturated or unsaturated being determined by well known chemical tests and not by any method of determining whether the molecules have a tendency to remain stable or to become unstable when quickly subjected to heat.

One of the important features in the Deppe process which you fail to comment on (and, by the way, I was not consulted or notified that you expected to publish this article or I should have been glad to have made these suggestions) is the fact that the Deppe method avoids subjecting the mixture to an abrupt cracking or polymerization producing unstable and heavier molecules as shown in Professor Wilson's tests. You will note particularly the emphasis we place on progressive heating and in this respect Mr. Howard's laboratory work followed more closely the Deppe methods by removing the lighter products before the heavier products were acted upon by increasing temperature.

H. P. DEPPÉ.

We note that Mr. Deppe was surprised to read that it was necessary to raise the gasoline to a temperature of 425 deg. Fahr., from which we infer that this is not the temperature he uses, but we fail to find in his communication any information as to what is the maximum temperature used in his system.

If we consider the gaseous mixture as an absolutely homogeneous mass, it is a comparatively simple matter to calculate what temperature is necessary in order that a mixture of any particular proportion and under any particular pressure may remain in the gaseous state after the fuel has been once completely vaporized. But it is a rather different problem to determine the temperature to which the media which carry heat to the fuel must be raised. For instance, if it were found that the fuel in a certain mixture under a certain pressure would not separate out at a minimum temperature of 150 deg., the medium through which heat was imparted to the fuel must evidently be raised to a materially higher temperature than 150 deg., for if it was not, the gasoline could not possibly reach 150 deg. within a definite time. How much higher its temperature must be would depend upon the time available for the volatilization of the fuel for one thing and the fineness of spraying for another. As to the time factor, if the gas passes through the manifold at the rate of 150 ft. per second and the heating surface is 6 in. long, the length of time that any particular portion of the charge is near the heating element and under its influence is one three-hundredth part of a second.

We do not believe that the vacuum in the intake manifold is a very important factor in this connection, for although the temperature of vaporization is directly proportional to the absolute pressure, and this is comparatively low when the engine is throttled, there are certain conditions of engine operation when the manifold pressure is very close to atmospheric, and the heat supply, of course, must be adequate to meet these most unfavorable conditions.—EDITOR.

Automobiles in Madagascar

FRENCH automobiles are in the lead in the Island of Madagascar, about 116 of the 159 cars there being made by French manufacturers. Thirty-eight cars are of American make, and all but three of these are privately owned. The majority of the French cars are owned by the Government. Two Italian and three British cars are on the island. About three tractors are used for agriculture and about 79 motor cycles are in use. But seven of these latter vehicles are American.

On the neighboring island of Mauritius, which has a smaller population than Madagascar, there are 1600 cars. On the Island of Reunion there are 30 or 35 cars.

This information has been furnished by the American Consul at Tananarive, Madagascar. American consular officers at any foreign city will furnish such information directly to any American asking for it.

The Study of Car Markets Demands Careful Analysis

The possible future market for any one manufacturer can be determined by an analysis of the past history of his market in its relation to that of all his competitors. The author explains how this may be done.

By Harry Tipper

SO far, in the discussion of this subject, it has been impossible to go any further than the basic economic conditions, the channels of distribution, and the economic requirements of those channels. To be at all effective, these considerations must be applied by the manufacturer of the automobile to the requirements of his own organization, considering the product which he is dealing with, the production and the character of the organization as it stands. In order to do this, the manufacturer must have some very definite way of arriving at

First—The future market for his particular product in comparison with the present production.

Second—The plans necessary to secure that market.

Third—The least operating cost at which those plans can be effectuated.

In order to determine the market, it is necessary to know the fundamental facts concerning

First—Tendency of future registration.

Second—Life of the car.

Third—Variation in the territorial developments in each of the territories.

Fourth—Character and tendency of the competition.

Fifth—Relation in the market in the different price groups as intimately as possible.

Sixth—Tendency as to styles, types and models.

While these elements are also part of the production necessities, they are much more intimately a part of the marketing considerations.

THE accuracy with which the past growth of registration, in relation to population and wealth, is considered, will almost govern the efficiency of the marketing calculations as to plans based upon these considerations. The total market for new cars is based upon the probable increase in registration. The increase in production capacity in comparison with this increase in registration offers an indication of the probable tendency of competition.

The more efficient concerns tend to grow somewhat more rapidly than the general growth of the business in which they are engaged so that it is possible for the market to be enlarged by an increase of efficiency in the same price group and under the same general conditions of competition. What it means is that the efficient concerns, in addition to absorbing the natural increase of the market, succeed in taking away the potential business from the less efficient concerns so that they grow faster than the increase in the total market by that process. Having in mind these considerations, the general market should be known as to the following items:

(a) The tendency of production and registration with relation to tendencies in population and wealth established. (Some of this information has been given to subscribers of AUTOMOTIVE INDUSTRIES in earlier articles.)

The method of calculating such tendencies is of great importance. The ordinary percentage curve is of no value in such a connection because it is not possible to calculate a normal growth from that so that the future may be safely predicted. It is necessary that these calculations should be based upon the modern statistical practice in this respect such as is used by the actuaries and of which the application of Gomperz Law to economic factors is the most important example.

(b) These tendencies should be determined also in relation to the growth of the different automobiles, divided by groups such as price groups, so that the manufacturer will be able to determine the limits of his section of the market as well as the enlargement of the market to be secured from any change in his price policy.

(c) To carry this consideration of the market to the point where a thorough application can be made, the same calculations should be arranged for the different states or on some territorial basis, which would enable the manufacturer to calculate his market for each distributing point and the territory adjacent thereto.

The accuracy with which the past growth of registration, in relation to population and wealth, is considered will almost govern the efficiency of the marketing calculations as to plans based upon these considerations. The total market for new cars is based upon the probable increase in registration. The increase in production capacity in comparison with this increase in registration offers an indication of the probable tendency of competition. The consideration of production by price groups and the tendency of that production indicates the probable action of the market in relation to automobiles involving the expenditure of different amounts of money. Properly worked out, this curve will show the true relation regardless of inflation and deflation which may affect prices for a short period.

If the production capacity is growing more rapidly than the registration, especially in certain groups, the tendency of competition will be toward readjustments in values, more intensive marketing efforts, and a more definite pressure on the distribution channels. An examination of these factors in connection with the different states will indicate the variation in the marketing possibilities in those areas and therefore the proportion of business to be expected from those areas and the amount of sales pressure which can be economically put upon each area in order to effectuate the probable sale. It is advisable where possible that the manufacturer should also plot out his own relation to his competitors within the same price group, not from the amount of production so much as from the tendency in

their production efforts.

In order to make this case a little clearer, we will take the case of two manufacturers, A and B, in the $2,000 to $3,000 price group.

The total production predicted for 1923 is 1,800,000 passenger cars.

The total registration predicted is a little over 11,000,000 passenger cars.

In both of these cases trucks have been eliminated.

For the last four years the price group mentioned has run 4 to 4½ per cent.

For 1923 the expected percentage is 4 per cent, which would give for this group a possible market of 72,000 cars for that year.

Car Manufacturer "A"

1916.....Started
1917.....Reached capacity
1918.....Dropped 15%
1919.....Same production as 1918
1920.....Increased production over 1917, 15%
1921.....Dropped 5% below 1917 production

Car Manufacturer "B"

1917.....Started
1918.....Production 60% of Car "A"
1919.....120% of Car "A" production
1920.....120% of Car "A" production
1921.....140% of Car "A" production

Car "A"—1921 Production 1200—2%
Car "B"—1921 Production 1680—2.8%
Car "A"—1923 Market probabilities 2.0%—72,000 cars—1440
Car "B"—1923 Market probabilities 2.8% of 72,000 cars—2016

The tendency of Car "A" 's activity has been decreasing so that the market for Car "A" in 1923 would be 2% — 5% of 2% = 1368 cars.

The tendency of Car "B" has been to increase the effective activity very rapidly, an average of 35 per cent increase in each of 3 years.

With increased competition, this may be harder to maintain, but the market is

2.8% + 35% of 2.8% of 72,000 cars.
Total market probability 2690 cars.

Car "B", continuing its steady growth, should be able to increase its production in 1923 to 2600 cars which is about 3 per cent of the market for that price group. In other words, Car "B" 's prospective business is increasing more rapidly than the group, whereas Car "A" 's prospective business is not increasing with the same rapidity as the group production and registration. This is simply carrying the expected general market, the expected group market, and the particular manufacturer's production forward over the next year in order that consideration may be given to the marketing plans necessary to develop the matter.

The same calculations should be made for each state or each territory into which the country has been divided by the manufacturer for purposes of his own distribution. Comparisons should be made in each of these territories so that the manufacturer may know the relation between his own growth in business, the growth of registration in the territory in his price group, the expected market and his own probable expectation of business.

As a hypothetical case, take State A as follows for Car Manufacturers A and B.

STATE A

Registration 100,000 1919
125,000 1920
147,000 1921

In price groups:
1919— 54,000 under $1,000
37,000 between $1,000 and $2,000
4,600 between $2,000 and $3,000
5,400 over $3,000
1920— 90,000 under $1,000
25,000 between $1,000 and $2,000
5,000 between $2,000 and $3,000
5,000 over $3,000
1921—103,000 under $1,000
30,000 between $1,000 and $2,000
6,000 between $2,000 and $3,000
8,000 over $3,000

State registration three years in the $2,000 to $3,000 group:

1919	1920	1921
4,600	5,000	6,000
	Increase 8.7%	20%

Car Manufacturer A's sales in State A:

1919	1920	1921
138	140	141
	Increase 1.4%	7%

Car Manufacturer B's sales in State A:

1919	1920	1921
90	120	165
	Increase 30%	37%

The relative position of the two manufacturers indicates the necessity for close analysis of respective methods and the reasons for the changes in effective activity.

This development will be continued in analysis in a later article.

The Thirteen Points

SINCE the President's Conference on Unemployment made its recommendations and adjourned last October, when it was estimated that 3,500,000 persons were jobless, concrete results are already apparent, and Secretary of Commerce Hoover, chairman of the conference, names 13 points, which are:

1. Public opinion, for the first time in American history, has been focused on unemployment.

2. Municipal committees are organized for the first time on a nation-wide scale to relieve it.

3. A national clearing house is ready to assist the municipalities, with district representatives in the field.

4. Industry is assuming a share of its responsibility to the unemployed.

5. Municipal bond sales for public works have broken all previous records.

6. Congress has inaugurated important public works.

7. A large appropriation for the United States Employment Service is before Congress.

8. A variety of other measures have been introduced in Congress to carry out the recommendations of the conference, such as Senator Kenyon's bill for long-range planning of public works.

9. Impetus is being given public education as to the nature of the problem of unemployment.

10. A scientific basis for future research is now being laid.

11. The construction industries are being organized nationally and locally under public direction, as, for example, in St. Louis.

12. In other notoriously seasonal and intermittent industries, such as the soft coal industry, stabilization studies are being planned.

13. A thorough investigation of methods for controlling the business cycle is in progress.

The conference is now in touch with all cities of the United States of more than 20,000 population and 19 regional directors cover practically the entire Union. They report regularly to Col. Arthur Woods, chairman of the Emergency Committee in Washington.

AUTOMOTIVE INDUSTRIES
The Automobile
Reg. U. S. Pat. Off.

PUBLISHED WEEKLY
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Vol. XLVI Thursday, March 23, 1922 No. 12

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Foreign Countries.....One Year, 6.00

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Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; A. C. Pearson, Treasurer; Fritz J. Frank, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of Associated Business Papers, Inc.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly) July, 1907.

Leadership

THE position of being a leader entails a responsibility for leadership. Factory officials sometimes fail to realize the weight that is attached to their words or they would, when talking to organization gatherings, pay more attention to preparation of the subject matter.

Selling organizations are especially subject to hearing "wind contests" which may momentarily enthuse them but later, when given sober thought, cause unfavorable reaction toward the subject matter and the speaker. Such contests tend also to lessen the faith which the salesmen may have in the leaders and no dealer organization can succeed without faith and plenty of it.

As competition becomes keener, men need something solid to chew on. Real fighters gain their objective better by knowing the obstacles. The selling organization must be composed of fighters these days in order to win, hence it is up to the leaders to tell these fighters how to overcome the obstacles, not to paint them out with fine words.

Facts, if properly presented, can give a strong stimulus to any organization and who is so well equipped to tell these facts in the right way as the leaders.

Loss of Power at High Altitudes

DURING the period of intense aircraft development we heard a good deal about the loss of engine power at high altitudes and means for eliminating this loss, or at least reducing it. Considerable trouble from this same cause is experienced with automobiles and other types of automotive vehicles in Mexico and South American countries of a mountainous character. For instance, vehicles that are a little shy on power for use in lowlands are quite impractical at altitudes such as found in Mexico.

It is generally held that the power of an engine decreases directly with the density of the atmosphere in which it is operating, but this is not strictly correct as regards the ordinary engine adjusted for use in low countries. In the case of such engines the loss in power is materially greater. There are really three distinct causes of power loss when the engine works in a rare atmosphere. In the first place, the amount of air taken into the cylinder during each inlet stroke is less in direct proportion to the lowering of the atmospheric pressure, and if this air were utilized with equal efficiency as the air taken in when the engine works at sea level, the power would decrease in the same proportion as the air pressure. Unfortunately the air is not used to the same advantage. This is due partly to the fact that the compression is lower, and the thermal efficiency decreases with the compression. On the other hand, the carbureter will be adjusted for operation at low altitudes and will give too rich a mixture at high altitudes. Of course, a mixture slightly richer than that containing just enough gasoline so that all of it can be burned by the air present, will give more power than the theoretically correct mixture, but the carbureter is apt to be set to give this maximum power mixture in the first place and in that case the mixture which it delivers at high altitudes will be over-rich and will give poor economy as well as reduced power.

Of these various causes for the falling off in power of engines at high altitudes some can be readily eliminated. For instance, the change in the mixture proportion can be easily corrected by adjusting the carbureter needle valve or by the replacement of the carbureter nozzle by a slightly smaller one. The reduction in the compression is less easily compensated for. The only real remedy consists in reducing the compression space, which in the case of detachable head engines can be done by planing or milling off the cylinder block top face or the cylinder head, in whichever the compression space happens to be, but this involves the complete disassembling and reassembling of the engine, in addition to the machine work on the block or head and consequently entails rather heavy expense.

The most radical and effective method would consist in providing the engine with a super-charger, as has been done for some time in connection with air-

craft engines for high altitude flying. This overcomes all three causes for the loss of power at the same time. The engine then can be given a full charge, its compression will be the same as at sea level without super compression, and the carbureter will be adjusted to give the proper mixture proportion under the conditions under which charge is forced into the cylinders. Unfortunately, such superchargers cannot readily be attached to the engines of standard cars, and the trouble from loss of power is probably not sufficiently severe and the market in high altitude districts not sufficiently large to warrant the building of special cars embodying supercharging equipment.

Realizing the Problem

THE question often arises as to what can we do now to succeed or make our business progress. This question is apt to be the result of looking the field over with the idea of finding more worlds to conquer; of seeking an outlet for energy as if the mere application of energy was in itself commendable. "What is the problem to be solved?" should, in many cases, be substituted for "what can we do?" It is not a matter of the phrasing of these two questions, but of the attitude of mind as expressed by them.

Careful and accurate analysis of conditions will lay bare the problem and aid in determining the method to be employed in its solution. The realization that there is a problem to be solved tends to coordinate effort to be expended and direct it in the proper channels.

Accessibility and Service Costs

NO one who has any knowledge of the service business questions the desirability of construction which is readily accessible, but designers too often neglect this factor, and are so often dominated by considerations of easy production that the problem of the service station is entirely overlooked. A part or an assembly is frequently ideal from the production or assembling standpoint, but when placed in the vehicle is so difficult to dismantle that the time required for the service operation is two or three times as long as it would be if due consideration were given in the first place to making it easily reached and as easily taken apart or removed as it was easy to assemble and install. It is, for example, a simple matter to place a clutch in the flywheel of an engine when the latter is detached from the gearset, as in a normal assembling line, but in some cars it is necessary to not only remove the gearset before the clutch can be taken out, but before this can be done the rear end of the frame must be blocked up, the springs disconnected and the axle moved back!

A reputation for moderate cost for repair work, when this is necessary, is coming to be regarded as more and more important by purchasers who are now car owners and who have, as a rule, had some unpleasant experiences in this line, which, if the truth were known, were in many instances quite largely due to inaccessibility. In any case, service costs must be decreased, and one important means to this end is the use of accessible construction. Executives should see that this fact is given due consideration by their engineering departments, and should for this reason encourage closer contact between that department and the service stations, to whom they must look for the care of their product.

This situation does not apply to passenger cars alone. It is perhaps more important in the case of trucks and tractors. One of the latest designs of tractor is laid out in such a way that every important unit can be easily detached, in most cases without disturbing adjacent units. To do this has materially increased the cost of the machine, but the manufacturer, who is one of the largest producers in this field, is convinced that the greater accessibility secured will soon offset the higher first cost, and thus prove a better investment for the farmers who buy and must maintain their machines. Can anyone doubt that this is a sane and far-sighted policy?

"God Helps Those—"

EFFECTIVE handling of industrial relations depends chiefly upon the provision of opportunity for the development of the individuals making up the working force. Discontent usually arises, if the trouble is traced to its source, from the fact that too many jobs fail to provide sufficient interest in themselves to allow for continuous personal growth on the part of the worker. In many cases a given job provides neither interest within itself nor training for promotion to more attractive work. One of these factors is necessary.

One excellent way to provide workers with an opportunity for personal development is through the maintenance of an up-to-date and useful factory library. Such a library has been established in a number of automotive plants and serves a useful purpose, especially in those cases where it is kept supplied with current business books and where some effort is made to "sell" the library to the men.

To keep its factory library in condition for maximum use, for example, one of the large truck companies has written to various well-known publishers of business books asking for their latest catalogs. This particular firm has for a long time maintained an excellent general library for its employees, comprising works on economic and social subjects, as well as literature of various kinds. It is now about to establish a technical library. And the interesting part about this factory library is that it is in constant use and has played its part in making successful the broad and intelligent industrial relations policy of the organization.

The catalogs of the better business book publishers might make interesting reading and might furnish some worth-while ideas for those in charge of factory personnel work. To provide workers with books specially adapted to their particular work is to give to these employees an excellent opportunity for self-development—and that old maxim that "God helps those who help themselves" has an important place in any discussion of industrial relations.

Quarter Will Meet Early Predictions

Production of January and February More Than Comes Up to Expectations

By JAMES DALTON

NEW YORK, March 22—Predictions that production of passenger cars and trucks the first quarter of 1922 would show a material increase over the same period in 1921 have been more than justified by the first two months. The February total was approximately 129,500 against 90,486 in January, 78,995 in December and 116,349 in November.

Carload shipments for January and February this year, including the Ford Detroit plant, totalled 34,841 as compared with 16,471 for the same months last year and 45,552 for the same period in 1920, the biggest year the industry ever had. In making comparisons with 1920, however, it is only fair to state that the number of vehicles driven away from the factories in January and February was 73,002 while this year it was 17,347. In 1921 it was 10,692.

March Gain Just as Favorable

But no matter on what basis comparisons are made, the showing thus far this year is very creditable. It is probable the gain this month over March 1921 will be fully as favorable, but it is likely that the other months of the year, except for the last quarter, will show considerably smaller increases as compared with the corresponding months in 1921. There may even be a decline in passenger car production in the third quarter.

Nothing will be gained by exaggerated expectations for the year as a whole. The fact remains, nevertheless, that the industry has made a remarkable recovery since the close of 1921 and that the aggregate of business for the 12 months will be very gratifying.

While passenger car makers, as a whole, had a good year in 1921, the truck manufacturers, with a very few exceptions, did practically nothing and the volume of sales by parts makers was not as large as the production of vehicles would indicate. The proportionate gains in the truck field this year have been fully as large as in the motor car branch of the industry and parts producers have had a substantial increase in sales because the inventories of vehicle builders have been greatly reduced.

Reports from the parts and acces-

(*Continued on page* 690)

Business in Brief

NEW YORK, March 22—Trading in stocks is on a broad scale and the market is buoyant.

Railroad freight traffic is increasing and the number of idle freight cars is decreasing. This is true particularly in the West.

There is slightly increased activity in the iron and steel industry with plants operating around 50 per cent of capacity.

Improved crop prospects are reported in the Southwest because of good weather conditions. Corn and cotton planting is under way east of the Mississippi, but has been delayed by rain in parts of Texas.

Grain movement from the farms has been restricted somewhat by lower prices, bad roads and increased field activity. Stocks on hand are comparatively small.

Trade in primary textile markets is dull except in seasonal lines. Woolens for spring are fairly active.

Bank clearings for the week ending March 16 were $6,636,104,000, a gain of 4.8 per cent over the preceding week, but a loss of 4.7 per cent as compared with the same week last year.

There has been recently a considerable decline in exports of wheat, flour and corn.

Factory employment in New York State increased 3 per cent in February.

Activity in building construction continues. Total for 27 Northwestern States in February was $177,365,000, an increase of 73 per cent over February, 1921.

Little public interest is apparent in the coal strike which seems certain on April 1.

Stevens-Duryea Asks for 6 Months' Extension

SPRINGFIELD, MASS., March 21—Stevens-Duryea has mailed letters to its creditors asking for an extension of six months to meet its obligations. The annual meeting, which was set originally for March 13 but postponed, has again been postponed until March 27, and it is considered unlikely that it will take place at that time, as more time probably will be required to present an intelligent and satisfactory report to the stockholders.

George M. Berry, treasurer of the company, says the general outlook has improved, but that it is difficult to borrow money for working capital at this time. He is hopeful that the extension will be granted and believes that if it is, the difficulties of the company can be worked out satisfactorily.

The plant, which has been running three days a week some time past, has been placed on a five day a week basis, curtailment in certain departments.

New Overland Plan Has Willys' Favor

Replaces Bank Proposal—Stockholders Will Be Asked for Their Approval

NEW YORK, March 20—Preferred stock holders of the Willys-Overland Co., who hold the veto power, have been asked to approve a plan under which the bank creditors of the company agree to accept $16,500,000 in 7 per cent bonds, maturing Dec. 1, 1923, to retire the present unsecured bank loans. These bonds would be secured by fixed assets of the company in such a way that the current assets would be available as working capital.

The preferred stock of the Willys-Overland company stipulate that no encumbrance can be placed upon the fixed assets without the consent of holders of 75 per cent of the preferred stock. It is understood that the Stephens interests, which own considerably more than one-third of the preferred, are agreeable to this plan which has been accepted by the reorganized board of directors.

Willys Approves Plan

The new plan, which also has been approved by John N. Willys and the officers of the company, as well as by the directors, is a very material modification of the reorganization proposition originally worked out by the bank creditors. The first proposal was that the company should be permanently refinanced by issuing $25,000,000 in first mortgage bonds. The bank proposed to pay $18,000,000 of this amount to pay the $16,500,000 bank loans and commissions incidental to them. The other $7,000,000 would have been held for emergencies as working capital.

The proposition for a mortgage bond issue met with the unalterable opposition of Willys and the Stephens interests. When the bankers found that it would be impossible to have it accepted either by the directors or by 75 per cent of the preferred stockholders, it was revamped into the program which has been accepted by the directors.

The new Toledo directors of the company were in New York for two days last week, conferring with the bankers, and it is understood that a complete agreement was reached. John N. Willys will remain as president of the company, and the bankers expressed gratification because C. B. Wilson, the vice-president, has been made general manager.

The following statement, in reference to the refinancing plan has been issued by Ralph Van Vechten, vice-president of the Continental and Commercial National Bank of Chicago, and chairman of the Bank Creditors' Committee:

The Willys-Overland company has per-

(*Continued on page* 690)

Samson Plans Made for Financing Sales

Provide for Payments for Tractors According to Income Farmer Receives

DETROIT, March 20—General Motors Acceptance Corp. has worked out a series of plans for the financing of sales of Samson tractors and farm implements to the farmers, whereby the payments are arranged according to the income of the buyer from his products. Examples of the way the plans operate are as follows:

Ability to Pay Considered

Plan No. 1 is recommended for sales to dairy farmers or those having a regular monthly income. This provides for a down payment of 30 per cent in cash and equal monthly payments over a period of twelve months or less, according to the ability to pay.

Plan No. 2 is recommended for sales to farmers raising cotton or other yearly crops. This provides a down payment of 40 per cent in cash and the balance in one payment in twelve months or less.

Plan No. 3 is recommended for sales to farmers raising an annual crop and live stock. This provides for two payments, the first in six months or less, the second in twelve months or less, with a one-third cash down payment.

Plan No. 4 provides for two deferred payments of eight and eighteen months with a down payment of 40 per cent. This permits the final payment to be spread over two crops and allows the use of the tractor and implements in preparing the soil for each crop.

Plans also have been worked out for the disposal of used cars or trucks taken in by dealers in the rural districts in part payment for tractors and implements. One of these provides for a 40 per cent down payment with equal monthly payments for twelve months or less. The other is for 50 per cent down with one deferred payment in seven months or less.

Provision for Rebate

On the monthly payment plan a rebate of one-half of one per cent a month will be made where the entire indebtedness is met before due. A rebate of one per cent a month is allowed for each month of anticipation under plan No. 2. Under plans No. 3 and No. 4 the rebate is one per cent a month on each payment prepaid for each full month of anticipation.

The wholesale plan is a method of financing factory shipments of Samson tractors, trucks and power implements to be stored either in a warehouse or on the dealer's showroom floor. Under this plan, Samson products may be shipped by freight direct to the dealer or by the manufacturer to a sub-dealer for the account of the direct dealer.

Only enough products are financed to enable the dealer to have a representative stock and to enable prompt delivery to customers. No stock will be financed which the dealer cannot sell at retail before the maturity of the note. All papers in connection with the transaction are handled through the local bank of the dealer. The dealer must pay 15 per cent of the invoice price of the products. The differential charged by the company is three-quarters of one per cent on the 85 per cent financed. Products remain the property of the finance corporation until fully paid for. If paid before maturity of the note, refunds of one-fortieth of one per cent are provided for each day the money is not used after the first month.

No notes covering invoices will be drawn for more than six months, because no more should be bought than can be sold in six months. Wholesale indebtedness should be cleaned up at least once a year, the company holds, at a time when collections are best in the territory. This clean-up date will be determined by the acceptance branch under which the dealer is operating and which will notify him.

Under the wholesale finance plan all products will be financed. Under the retail plan, Samson power-drawn implements will not be financed except when sold in conjunction with a tractor. Bank fees are paid by the corporation for handling the wholesale transactions. Insurance on products up to the time the dealer note is paid is covered by the differential rate.

TANKS FOR THE JUNGLE

LONDON, March 8 (by mail)—Sir Frederick Lugard, thirty years administrator in British Tropical Africa, says in a book just published that mechanical transport has a big future in Africa.

He considered it unnecessary to build railroads and metalled roads through the jungle, and suggests that tanks similar to those used in the war should be adopted instead. "Roller-track" vehicles, he claims, would create rather than destroy roads, and would be very economical in running.

These tractors should be of 100 H.P., and capable of drawing 20 ton trailers.

Ford Extends Working Week and Increases Employees

DETROIT, March 21—In connection with its extension of manufacturing to a five-day week schedule, starting this week, the Ford Motor Co. is increasing the number of employees to round out the forces in all departments.

A considerable number will be added over a period of weeks bringing the total close to the 48,000 mark. In a letter to American Legion officers in this city, Edsel Ford, president of the company, said ex-service men would be favored as far as possible in making assignments to the new work.

New Company Likely for Old Times Square

Provision Made in Reorganization of Consolidated Distributors to Pay Creditors

NEW YORK, March 21—The Consolidated Distributors, Inc., formerly the Times Square Auto Supply Co., which went into receivership, is to be reorganized through the formation of a new corporation, if a plan being considered by the reorganization committee is adopted. The new company, it is planned, would acquire such assets of the old company not disposed of by the receiver or in connection with the reorganization plan.

Under that plan the new company would issue four year notes and first and second preferred and common stock. Banking creditors consenting to the reorganization would receive 100 per cent of their claims in the notes, carrying a 6 per cent interest rate, or in participation certificates of one of the banks as trustee for all the banks.

To Pay 65 Per Cent of Claims

The general creditors, exclusive of loan creditors whose claims are subordinate to bank loans and of holders of scrip dividends, would receive 65 per cent of their claims in first preferred stock of $10 par value and cumulative as to 7 per cent dividends. The present stockholders would be given a share of new second preferred stock for 10 shares of old common stock. What use would be made of 300,000 shares of common stock which would be issued has not been announced.

Shuler Axle Acquires Assets of Old Company

LOUISVILLE, KY., March 18—The Shuler Axle Co., Inc., has acquired the entire assets of the Shuler Axle Manufacturing Co. and is already in operation on the production of front axles for motor trucks, trailers, tractors, etc.

W. F. Robertson of Cincinnati, president of the Robertson Steel & Iron Co., is president of the company, and W. H. May of Louisville is secretary and treasurer.

The company is beginning operations with a paid-up capital stock of $150,000, which assures ample cash resources for immediate and continuous development of the business. The line of front axles which was made by the Shuler Axle Manufacturing Co. will be continued and plans have been completed for additions to the line.

Frank A. Shuler will continue to act as general manager of the new company and will have personal charge over the increased manufacturing program. Harry W. Helms has been retained as sales manager. Other department heads who have been with the Shuler organization since its inception will continue with their previous activities.

Elgin Stockholders to Help Boost Sales

Asked to Secure Names of Prospects for Reference to Local Dealers

CHICAGO, March 18—A sales boosting meeting attended by about 2000 stockholders was held at Orchestra Hall here by the Elgin Motor Car Corp. in preparation for the marketing of the new model Elgin, which was exhibited at recent shows. A chassis of the model was displayed and its various improvements from an engineering standpoint were explained. The stockholders were requested to gather names of prospective purchasers and send them to the general offices of the company at Argo, from where they will be referred to dealers in the localities from which they came.

This plan of aiding sales was explained by C. S. Rieman, president and general manager of the company, who said that the word of mouth advertising resulting from such stockholders' meetings was of great value. He pointed out that in addition to the 2000 attending the meeting, 17,000 other stockholders who are scattered throughout the country would receive a full report of the proceedings and would be asked to assist in the sales plan.

Production of the new model has not yet started, and the prices at which the various styles will be retailed have not been announced. The car will be made in phaeton, roadster, coupe, sedan and sport bodies. It will have a 118-in. wheel base.

The meeting of stockholders was addressed by Mayor William Hale Thompson, A. Vere Martin, vice-president of the Lake State Bank, and President Rieman.

Governors of Aeronautical Chamber Choose Officers

NEW YORK, March 17—At a meeting of the executive offices here, the board of governors of the Aeronautical Chamber of Commerce of America, Inc., elected the following officers:

President, Grover C. Loening, president of the Loening Aeronautical Engineering Co.; first vice-president, Charles F. Redden, president, Aeromarine Airways, Inc.; second vice-president, C. C. Witmer, president, Airship Manufacturing Co. of America; treasurer, B. E. Bushnell, director of sales, Stewart Hartshorn Co.; secretary and general manager, S. S. Bradley, Manufacturers Aircraft Association, Inc.; assistant secretary and assistant treasurer, Luther K. Bell.

U. & J. SALES PLANT BURNS

CHICAGO, March 20—The U. & J. Sales Co., manufacturer of carbureters and other automobile accessories, whose factory at 507 West Jackson Boulevard was destroyed by fire March 14, announces that it will lease or buy another building and resume production at once. The company's loss, including machinery and stock, was about $200,000. About 100 employees were affected. C. A. Kemper, sales manager, said that the company's patterns were at the foundry and were not destroyed.

Worker Succeeds Tolles as President of Phoenix

EAU CLAIRE, WIS., March 20.—C. L. Tolles, for many years president and directing head of the Phoenix Manufacturing Co., manufacturing heavy duty tractors, log haulers and logging and sawmill equipment, has resigned, although remaining a stockholder and director. Robert D. Briggs, secretary and treasurer also has resigned these offices.

Tolles is succeeded by J. G. Worker, vice-president and general manager. H. J. Thompson takes the place of Briggs as secretary and treasurer. A movement is under way to consolidate the Phoenix company and the McDonough Manufacturing Co., of Eau Claire, the latter manufacturing metal and wood working machinery, machine tools, saw and planing mill equipment, etc. Both concerns operate foundries and machine shops.

Coats Steam Car Removes Sales Offices to Chicago

CHICAGO. March 20 — The Coats Steam Car Co. has moved its general sales offices from Indianpolis to Chicago and established them at 2337 Michigan Avenue where G. A. Coats, president of the company, will make his headquarters. Miss I. Siefker is office manager.

The company has acquired the factory of the Stewart Motor Car Co. at Bowling Green, Ohio, and announces that it expects to start production in the near future. The program of the company calls for a minimum output of 10,000 cars the first year, and on this basis officials state that the first year's production is already oversold. A phaeton and a roadster will be made, each to retail for $1,085, and it is planned to produce a sedan later at $1,495.

The output of the Bowling Green factory will be marketed under the name of the Stewart-Coats Steam Car.

New Rolls-Royce Price Proves Big Sales Factor

SPRINGFIELD. MASS., March 18—Rolls-Royce of America, Inc., reports that the new price established two weeks ago has greatly stimulated interest, as expressed in sales as well as inquiries from all parts of the country from persons who are inclined to invest either in the phaeton or some special custom body design.

More cars are being turned out from the plant than at any time since production was resumed in the fall, and the prospects are that the plant force will be further increased April 1.

Franklin to Build Four at Syracuse

Good Labor Conditions Figure in Decision—Sixteen Cities Bid for Site

SYRACUSE, March 20—H. H. Franklin, president of the H. H. Franklin Manufacturing Co., has set aside all rumors that the Franklin Four, which will be on the market in April, 1923, will be built outside Syracuse. Following a conference of officials, he announced that Syracuse had been selected for the new plant which, it is estimated, will cost between $2,000,000 and $3,000,000. Sixteen cities made bids for the plant's location.

Definite plans for the production of the new car have not been developed, although a general working organization has been formed. It will take a year at least to have the new plant ready for operation, but it is understood that the big Messina Springs tract of 1000 acres just beyond the city limits will soon be the scene of construction not only of the Franklin factory but of an immense housing project.

Production in Present Plant

The first Franklin Fours will be made in the plant here. This is made possible by construction work completed a few months ago. Production of the Franklin six cylinder will not be reduced because of the new model. It is planned to manufacture 40 cars a day, with production steadily increasing.

Labor conditions are said to have been a big factor in the decision to stay here. Not since the Franklin company started manufacture has there been a strike in the plant. Relations between the company and its employees have been singularly happy and harmonious.

The development of the sales force is proceeding. A. G. Maney, vice-president, states that Franklin representation throughout the country will be greatly augmented this year to handle the new Four when it is put on the market.

"We are setting our mark at 250 new dealerships to begin with," Maney says. "But this number will be gradually added to in order to care for the distribution of the Franklin Four. We now have over 500 dealers and expect in time to have several thousand so that Franklin service may be made practically universal."

Boston Bankers Provide Wills $6,900,000 Credit

DETROIT, March 21—Arrangements have been made with Boston bankers by C. H. Wills & Co., maker of the Wills Sainte Claire car, under which they will be provided with a revolving credit of $6,900,000, which will run until July, 1923. This will provide a working capital entirely adequate to meet all needs and will relieve the company of all financial worries for more than a year, at least.

Campbell Is Named McGregor Successor

Latter's Widow Is Given Place on Directorate of Ford's Canadian Company

DETROIT, March 18—Wallace R. Campbell was named first vice-president and treasurer of the Ford Motor Co. of Canada, Ltd., to succeed the late Gordon M. McGregor, at a meeting of directors this week. Campbell was formerly secretary, assistant treasurer and assistant general manager of the company. Henry Ford is president.

When the Ford Motor Co. in Detroit was undergoing reorganization of its personnel a year ago, an effort was made by Ford to induce Campbell to join the Ford forces on this side of the border, first as general manager and then as treasurer. Campbell spent several weeks at the Highland Park plant at Ford's request and then decided to continue his allegiance to the Canadian company.

Mrs. McGregor will succeed her husband as director during the unexpired term of his directorate. This appointment was conferred as a tribute to the results achieved by McGregor in the development of the company from a $125,000 corporation to its present $10,000,000 capitalization.

P. W. Granjean, assistant secretary, becomes secretary and assistant treasurer. Other appointments to positions made vacant through the promotions are deferred temporarily.

Ford Ideas on Efficiency Carried to Lincoln Plant

DETROIT, March 17—Reorganization of factory facilities at the Lincoln plant to meet Ford ideas on efficiency are being carried through rapidly so as to whip the plant into shape for increased production. This work is progressing under the direction of Charles E. Sorensen, director of all Ford manufacturing operations, and P. E. Martin, Ford factory superintendent.

There is a liklihood of all the executive offices of the Ford company being housed in the Lincoln office building because of its position midway between the Highland Park and River Rouge plants.

Fire, Theft Underwriters Aiming at Uniform Policy

PHILADELPHIA, March 18—Automobile fire and theft underwriters are studying conditions closely to come to a uniform policy in proposed new forms of contracts. The losses incurred last year caused a general movement by underwriters toward a drastic change in the valuation of coverage. Falling prices of cars created a bad moral risk under established contracts.

At present some companies are issuing policies at a smaller cost, but covering only 75 per cent of the market value of the car at the time of loss. Others are keeping in force old forms, which cover the loss in full at increased rates. However, the tendency is to adopt the newer form. Some companies are contemplating issuing a graduating policy, the premium being graduated in accordance with the moral risk.

Kentucky Tables Bill to Put Dates on Tires

LOUISVILLE, KY., March 18—The bill of Representative E. A. Gullion of Henry County to require tire manufacturers to stamp the date of manufacture on tires sold in Kentucky was tabled in the House of Representatives.

F. J. Humbert, representative of Louisville, led a fight on the bill, asserting that its passage would work an unjustified hardship on tire manufacturers and dealers.

All Production Meeting Will Be Held by S. A. E.

DETROIT, March 20—The Detroit section of the Society of Automotive Engineers will hold a production meeting on March 24 at the Board of Commerce. The program represents an innovation, as it will be the first time the society has had a 100 per cent production meeting, according to the officers of the section.

The subject will be largely concerned with the manufacture of automobile gears, and the program is designed to include the men who produce the tools, those who furnish the machines, and those who use both the tools and machines actually to produce gears.

Papers will be presented as follows: S. O. Bjornberg, Illinois Tool Co., "How to Use Hobs"; R. S. Drummond, Gear Grinding Co., "Gear Grinding Machines"; John Edgar, Barber Coleman Co., "Hobbing Machines," and F. Lamborn, Dodge Brothers, "Hobbing Experiences."

Durant Motors Will Add to Its Plant in Canada

TORONTO, March 21—Several important announcements in reference to Durant Motors of Canada, Ltd., were made at a luncheon given by E. A. Wallberg, manager of the Toronto branch.

He said that new buildings would be added to the plant in the near future. The first will be a three-story fireproof structure, 600 ft. by 80 ft., one of the largest factory buildings in the Dominion. The Electric Auto-Lite Co. of Toledo is ready to install machinery in this building.

In addition to the Durant four and six, the Canadian plant at Leaside will turn out the Star and the Mason high-speed 1-ton truck.

Durant Motors of Canada will build at Leaside this year a school for the children of employees, and when building prices come down, will construct model houses for workmen.

Continues Petition to Sell Auto Stores

Creditors Seek Plans to Effect Greater Return Than at Public Sale

PHILADELPHIA, March 20—After counsel for the creditors had objected on the ground that their clients had no opportunity to express their desires, Judge Thompson, in United States District Court, continued a petition by receivers of the United Auto Stores, Inc., for permission to sell its assets.

The court ordered the receivers to issue notice to stockholders and creditors that the assets would be sold. Joseph L. Kun, assistant district attorney and counsel for the receivers, declared that the expenses of maintenance of the office here and the fifty-eight branch stores were greater than the income. As the result, stockholders and creditors of Edward B. P. Carrier, the 28-year-old promoter, he said, were incurring greater loss.

Jacob I. Weinstein and James J. O'Brien, representing the creditors, suggested a plan might be devised for the sale of the accessories at prices that would be better than for articles offered at public sale.

A tentative proposal, according to Abraham M. Ross, one of Carrier's lawyers, has been made by a group of accessory dealers in New York.

Former Jefferson Rubber President Is Arrested

JEFFERSON, WIS., March 20—Officials of the Jefferson Rubber Co. caused the arrest at New Castle, Ind., of Robert W. Lyons, promoter and former president of the company, on charges involving alleged shortages of about $3,000, said to have been discovered upon examination of accounts for income tax return purposes. A warrant also has been issued for C. R. Girton, associate of Mr. Lyons in promoting the company.

The Jefferson Rubber Co. was organized two and a half years ago, with $300,000 capital, and erected a plant, equipping it for the manufacture of tires, tubes and mechanical rubber goods. In the fall of 1921 a reorganization was effected, Jefferson stockholders taking entire charge. Lyons and Girton left Jefferson shortly thereafter.

TEMPLAR DECISION DELAYED

COLUMBUS, March 17—Judge Warner in the Franklin County Court has taken under advisement definite action in the receivership proceedings brought against the Templar Motors Co. by N. Clyburn of Washington, D. C., as a stockholder. The defendant company and officials have filed a long brief, and this is being considered. Decision will not be rendered until the evidence has been gone over.

Milwaukee Business Is on Old Bookings

While Parts Makers Report Better Situation New Trade Develops Slowly

MILWAUKEE, March 20—Indicative of the increased passenger car production growing out of a slowly but steadily improving early season demand is the fact that manufacturers of automotive parts in this market are daily receiving more shipping directions on contracts.

New business, however, is developing very slowly, the output being confined largely to the needs of regular customers whose bookings were made some time ago, with flexible delivery specifications framed because of the impossibility of anticipating current needs until the retail selling season opened and the demands upon car builders could be judged more accurately than in advance.

Manufacturers of patented automotive equipment are able to operate at a better schedule than other parts industries. This is due to the improved call from distributors and jobbers of such equipment catering to owners. The demand for standard accessories used as stock equipment by passenger car builders has increased proportionately to the call for engines, frames, transmissions and other major as well as minor parts.

Weather Helps Local Trade

A week to ten days of balmy spring weather, following a period of similar length when typical extreme winter conditions existed, has had a markedly beneficial effect upon retail sales of passenger cars here. During most of the past week temperatures were abnormally high for this season, with plenty of sunshine, and as a result there was a touch of "spring fever" which was reflected by a quickened call for cars.

The best business is reported by dealers featuring cars in the price class of $900 to $1500 for open types, and up to $2000 in closed types. However, Ford sales are showing a seasonable increase, and dealers in the higher range of values say that prospects are more amenable to reason, with sales gradualy increasing. Prospects for sales in April are regarded as much more favorable than they were a year ago at this time. This is not a mere guess on the part of dealers, but a prediction based on analysis of the market.

Packard Not to Abandon Twin Six Manufacture

DETROIT, March 21—Alvan Macauley, president of the Packard Motor Car Co., has issued a statement to distributors and dealers pointing out that there are more than 30,000 owners of Packard twin six cars in the United States and that the company, despite persistent rumors, has no intention of abandoning the twin six manufacture.

"The twin six must of necessity command a relatively high price," he said, "and we decided four years ago that we would not cater exclusively to the high price field but would make a Packard car to sell at a lower price. That is the reason for the company's presentation of the single six."

RACINE REPORTS SHOW IMPROVED CONDITIONS

RACINE, WIS., March 20—The industrial situation in this city, the second largest in Wisconsin and a center of the automotive and power farm equipment industries, has improved materially in the last two to three weeks. Some of the high lights are:

Mitchell Motors Co.—In a better position than for four to six months past. Orders picking up in all sections.

J. I. Case T. M. Co.—Gratifying reception accorded new Model X, five-passenger car. Production on both models increasing. More than 500 Case tractors sold in 60 days. Inquiries more numerous.

J. I. Case Plow Works Co.—Business improvement advances date of resumption of active production with 350 to 400 operatives, on Wallis tractor.

Harvey Spring & Forging Co.—Booked all spring needs for passenger cars of Nash, Mitchell and Case. Setting up remaining equipment. Plant on full capacity schedule; some departments working overtime.

H. & M. Body Corp. Force being increased. Original order from Hupp for 1922 bodies, numbering 10,000, increased to 20,000. Orders from Mitchell and other factories booked. Reinstatements made generally. Seeking more skilled workers.

Walker Manufacturing Co.—Motor equipment orders increasing, especially on jacks. Prospects best in six months or longer.

University Is Preparing Automotive Steel Experts

MADISON, WIS., March 20—To meet the increasing demand of motor car and parts manufacturers and other makers of machinery for highly trained men to make metallographic analyses of alloys and alloy steels, the department of mechanical engineering at the University of Wisconsin, Madison, has organized a new course in metallography with an enrollment of sixty-five students, under Prof. E. D. Fahlberg.

Mechanical engineering students are required to take the course so they may make the kind of study of alloys and alloy steels needed in shop work.

Truck Makers Buy on Greater Scale

Car Builders Also Help in Encouraging Parts Manufacturers in Detroit

DETROIT, March 21—Parts makers in the Detroit district have been greatly encouraged by the volume of business which has come to them since the turn of the year. A considerable number of plants are approaching an output of 50 per cent of capacity.

While the major part of the business has come and continues to come from a comparatively few companies, releases and new orders for supplies are coming in smaller volume from most of the companies in the industry. This would indicate that all manufacturers are sharing in the increased sales of motor cars. Truck builders also are buying on a scale which demonstrates a better market for commercial vehicles.

Some Report March Best Month

At a recent meeting of credit men representing some twenty-five companies in the Detroit and Cleveland districts, reports of better business were almost unanimous. In most cases February sales were at least double those of January, and in a few instances much more than that. March business in many instances will double those of February, and April will be better than March. Two or three reported that March will be the best month they ever had.

Collections on current business are excellent.

The chief element of doubt in the minds of the parts makers is what is going to happen after April, for they have few specifications beyond May 1.

Bearings Service Co. Makes Additions to Field Force

DETROIT, March 20—J. L. Whalen, former central district manager of the Bearings Service Co. of Detroit, has been named assistant sales manager and assigned to the central district with headquarters in Detroit. W. H. Anderson, former New York branch manager, has been named assistant sales manager and assigned to the eastern district, with headquarters also at Detroit. W. C. L. Hodgson will remain in Detroit as one of the assistant sales managers and has been assigned to the southern and western districts.

A. H. Pratt is now the company's New York branch manager. C. R. Norris, formerly branch manager at Newark, will be assistant manager. P. W. Daniels, assistant at the Philadelphia branch, has been made Newark branch manager. G. M. Flyum, former manager of the Brooklyn branch, has been succeeded by N. B. Keller, who resigned as manager of the Minneapolis branch.

Standard Mould Co. Resumes Dividends

Suspended Payments During Slump, in Company with Other Akron Manufacturers

AKRON, March 18—The Akron Standard Mould Co., manufacturer of rubber making and tire building machinery, is the first of the many Akron companies which were forced to suspend dividend payments during the slump in the automotive industry, to resume such dividend payments.

Announcement that the company will resume common stock dividends April 1 is considered one of the most important and optimistic developments in the rubber metropolis since the restriction of credit and diminished sales first forced all Akron companies to retrench and lay off thousands of men over a year ago.

Directors of the company have declared a 1 per cent dividend payable April 1 to stock of record March 15. It is understood the company expects to maintain the 1 per cent dividend payable monthly in the future, having paid all of its bank indebtedness.

Reflects General Improvement

Although the Akron Standard Mould Co. is not essentially a rubber factory, by reason of the fact that it specializes in tire building machinery, including tire moulds and cores, its existence and growth naturally depend solely upon the prosperity of the tire industry, and the fact that it is able to resume dividends is accepted as a definite reflection of material improvement in the tire industry in general. The company reports sales of $500,000 last year and announces that business is steadily increasing.

With very few exceptions all Akron manufacturers suspended dividends during the low ebb of the slump period.

Others are expected to follow the lead taken by Standard Mould, indicating a marked degree of improvement and a substantial stride toward normal.

New Selling Organization Incorporated in Porto Rico

SAN JUAN, PORTO RICO, March 15 (*by mail*)—Certificate of incorporation has been issued to the Porto Rico Tire & Rubber Co., Inc., with offices here and with an authorized capital of $50,000. The corporation, it is stated, will dedicate itself principally to the purchase and sales of automobiles and automotive equipment. The incorporators are A. Panzardi, L. Garcia Mendez, Ignacio Guasp and J. Gutierrez Guasp, all of San Juan.

Attention is directed to the possible confusion of the name of A. Panzardi, one of the incorporators, with that of Santiago A. Panzardi of the company of Santiago A. Panzardi, Inc., an old established firm that has represented several American cars for ten years or more and has branches throughout the Island. Santiago A. Panzardi, general sales and service manager of this corporation, is not connected with the new Porto Rico Tire & Rubber Co.

BUSINESS IN MARCH EXCEEDS ALL FOR 1921

MILWAUKEE, March 20—The Lavine Gear Co. of this city announces that its shipments of gears this month will be greater than its shipments for the entire year of 1921.

Stearns Declares Dividend; Iowa Resumes Ordering Cars

CLEVELAND, March 20—A quarterly dividend of 50 cents a share has been declared by the directors of the F. B. Stearns Co., maker of the Stearns car. This is one-half the rate that has prevailed since the stock was changed from a par value of $25 to no par.

President George W. Booker stated that business in March is better than it was the preceding month and that inquiries indicated the records would be better during the months of April, May and June. It also was stated that the first order received from Iowa for some time came into the factory last week.

Heavy Rains Prevent British Tractor Test

LONDON, March 3 (*by mail*)—The tractor demonstrations organized for March 1 and 2 near Exeter, England, have been cancelled owing to the effect of heavy rains on the soil. These were the first of a series of three demonstrations which were planned for early spring, summer and autumn this year, to be held in various parts of the country, instead of a national trial in the autumn.

Fifteen tractors, three self-contained rotary tillers and one garden cultivator had been entered for the event, which, incidentally, was the first tractor trial or demonstration organized in England canceled or even postponed.

The heavy rains during the latter end of February, however, had rendered plowing out of the question for at least a week after the arranged dates, even if continuous fine weather could have been relied upon for the first part of March.

FEES SHOW ONTARIO GAIN

OTTAWA, ONT., March 18—The Ontario government expects to get the sum of $3,500,000 from the licenses of motor vehicles in the province. This will mean an increase of about $500,000 over the figures for the past fiscal year. An order-in-council has been passed by the Ontario government making a nominal fee of $1 per annum payable on all motor vehicles owned by municipalities.

Fisher Body Extends Factory Facilities

Leases Plant in Cleveland—Standard Parts Business in 1921, $7,233,033

CLEVELAND, March 18—Two of Cleveland's largest industries, both of which are allied with the automotive industry, are riding along on business waves that are breaking more smoothly than they have for the past two years.

The Fisher Ohio Body Co. has found that the $6,000,000 new plant, in which it commenced production last September, is not large enough to accommodate its business and has taken a lease on the building of the Briggs Manufacturing Co., which is adjacent to its main plant. This acquisition will give an additional 175,000 square feet of space, which will be used to house the finishing business. E. E. Fisher, president of the Cleveland company, states that the entire production is now going to the Chandler, Cleveland and Chevrolet companies.

When the new Fisher plant was opened in this city, it was thought that the 850,000 square feet of manufacturing space was far in excess of the requirements, but seven months after it is running at capacity production and is turning out from 250 to 275 bodies daily.

Standard Parts Report

The annual statement of the Standard Parts Co., which has been in the hands of a receiver for nearly two years, shows that the company's net business in 1921 was $7,233,033, which is one-third below the record for the previous year.

On this business the company produced a profit of $316,380 before a heavy depreciation and inventory adjustments were made. During the year the company found it advisable to enter a depreciation of $398,341 and inventory adjustments of $204,348, leaving a net loss of $286,409.

Nothwithstanding the difficulties that were encountered, Receiver Frank Scott bettered the cash position of the company. This account rose from $428,661 on Dec. 31, 1921, to $613,881 on March 1 of the present year. The sum of $4,931,920 was disbursed to Dec. 31, 1921, and of this amount there were two dividends to creditors totaling $1,943,018.

In line with a general policy of retrenchment and the unification of the manufacturing end of the business, the plant of the Canton Forge Co. was sold for $293,500. Remaining equipment and inventory not available for the American Axle plant was sold for $59,000.

The receiver states that in the sixteen months of his administration he has finally reached the point where inventories reflect the true market value, while all obsolete material in the plants that are being operated has either been sold or marked down to scrap value. After adjustments the company's assets total $15,134,467, exclusive of patents.

Akron Likes Trade Acceptance System

Tire Makers Will Continue and Expand It Despite Outside Adverse Criticism

AKRON, March 18—The trade acceptance system employed by Akron tire manufacturers in negotiating with banks for their credit has vindicated itself and will be continued and expanded, despite the outside criticism aimed at the system, according to William O'Neil, vice-president and general manager of the General Tire & Rubber Co., and president of the Ohio State Savings & Trust Co. of Akron.

Speaking of the situation, O'Neil says:—

The plan adopted by Akron bankers and manufacturers of extending credit on orders booked for manufactured merchandise—in other words the trade acceptance plan—has been widely criticised and condemned both in and outside of Akron and by both manufacturers and bankers. But the trade acceptance system has been so effectively employed here for years that it is largely responsible for what and where Akron is to-day as one of the manufacturing centers of the world.

Bankers Approve

Akron bankers and manufacturers unite in recommending the system to other cities and other industries. The trade acceptance system has many advantages. It has helped to bridge the tire manufacturers over the seasonal dull periods. It has averted periodical lay-offs of men. It has kept production on an even keel for the manufacturers in times when business was dull have had the banks back of them ready to pay the wages of their employees, to pay their shipping bills and their raw material bills, accepting as security therefore the orders booked by those companies from their dealers. It is a tremendous advantage for an Akron manufacturer who receives a bona fide order for, say, $500,000 worth of tires and rubber goods, to take that paper to the bank and negotiate credit upon it sufficient to manufacture the goods ordered.

The success of this system has been reflected in mercantile lines and other business channels. It has benefited the merchant and it has likewise benefited the entire motoring public, for it has helped to reduce the cost of tire manufacture. In short, it has made possible the national, or rather the world-wide, business which Akron now is engaged in, for it has helped to stabilize local conditions.

Speaking both as a rubber manufacturer and as a banker, I firmly believe the trade acceptance system, if adopted in other cities, will help to similarly stabilize businesses and will work to the benefit of everyone. It is a system that is going to be continued in Akron, for we know what it has meant to us in the past and what it will mean to us in the future.

INDIA TARIFF INCREASED

WASHINGTON, March 18—Advices have been received by the Division of Foreign Tariffs of the Department of Commerce that a new schedule of import duties for British India became effective March 1. The new rates include an increase of from 20 to 30 per cent on motor vehicles which, under the Indian tariff laws, are classed as luxuries.

The general import duty was raised from 11 per cent to 15 per cent ad valorem. Railway material and machinery, etc., which heretofore had been dutiable at the low rate of 2½ per cent, in order to encourage the industrial development of British India, was advanced to 10 per cent ad valorem.

The import duty on lubricating oil was not changed. An excise duty of one anna per imperial gallon is levied upon all kerosene produced in India and Burma, while the custom on imported gasoline and motor spirits has advanced from 1½ to 2½ annas per imperial gallon.

Personnel of Zeder Begins Taking Shape

CLEVELAND, March 17—Although plans for the manufacture of the Zeder automobile by the Zeder Motor Co., in the plant of the Cleveland Tractor Co., in this city are largely in outline at present, it is believed the making of the car will start in the near future.

Tractors will continue to be made in the plant here in increased number as the demand this year is good.

The personnel of the organization is beginning to take shape. E. B. Wilson, former sales manager of the Willys Corp., is said to have been engaged to take charge of the merchandising end. R. T. Hodgkins, a vice-president of the Cleveland Tractor Co., is already planning the sales campaign, it is reported. J. O. Hahn former branch manager of the Studebaker in this city, is also to be a member of the organization.

One of the moves contemplated in financing the project is the doubling of the $6,000,000 capital of the tractor company. This corporation owns 110 acres of land with a frontage of 1200 feet on Euclid avenue, also frontages on both sides of the Nickel Plate railroad, St. Clair avenue and a frontage on the New York Central railroad.

Arrangements Completed for Frontenac Location

INDIANAPOLIS, March 20—With the departure for the East of Allan A. Ryan, New York capitalist and chairman of the board of directors of the Frontenac Motor Car Co. of this city, reports were confirmed that arrangements were practically completed for the purchase of an extended factory site for the new car.

Ryan was accompanied by William N. Thompson, president and general manager of the Stutz Motor Car Co. of America, Inc., another member of the directorate of the Frontenac company, who, with Ryan, has been active in its organization.

BENZ STATIONARY ENGINES

NEW YORK, March 21—A dispatch from Frankfort-on-the-Main says that a section of the Benz automobile works in Mannheim are being transformed for the construction of stationary motors by a special company with 40,000,000 marks stock capital.

Weight Forms Basis for New York Fees

Supplants Horse Power — New Car Owners Had Been Paying Less Than Old

ALBANY, March 21—New legislation of chief importance to motorists in New York state is confined chiefly to the two bills increasing registration fees of both passenger cars and trucks. In licensing passenger cars the legislature, at the recommendation of the tax commission, abandoned the old-time method of horsepower as a taxation basis. For the first time in this state weight will determine the amount of the registration fees, the cost being rated at 50 cents per 100 pounds for cars weighing, fully equipped, 3,500 pounds or less and 75 cents per 100 pounds for cars over 3,500 pounds.

With the recent price changes the motor experts of the state discovered, somewhat to their surprise, that owners of new cars registered for the first time this year were paying a lower fee than owners of similar cars purchased a year or two ago. The new system increased the registry fee by 10 to 15 per cent over existing rates. The minimum fee, hereafter will be $8. At present the minimum fee is $5 for a four-cylinder vehicle. The new registry plan will not go into effect until Jan. 1, 1923.

Commercial Vehicle Rates Higher

Rates on motor commercial vehicles have also been increased, but, through the representations made to Senator Lowman and others by motor truck interests, the legislators admitted that the fees first proposed were excessive, and substantial reductions were made. Notwithstanding this, the new motor truck fee for all vehicles will be 60 per cent higher than at present, a very material increase.

The new system imposes a fee of $8 per gross ton, making $16 the minimum for two tons or less. The fee for such commercial vehicles is now $10. The average 5-ton truck, which, when fully loaded, has a gross capacity of about 11-tons, will pay a fee of $88 instead of $55, as at present. These new motor truck fees will also go into effect on the first of next year.

No effort has been made to introduce a gasoline tax, which was hardly necessary in view of the fact that higher fees have been imposed all along the line on cars owned in this state.

CANADIAN OFFICE IN NEW YORK

OTTAWA, ONT., March 18—The office to be opened in New York by the Canadian Trade Commissioner there will be in operation on April 1. It is said that inquiries have been received with regard to prices of automobiles, trucks and accessories, and it is believed that a market can be secured for Canadian products.

Men of the Industry and What They Are Doing

Unwin Goes With National

Harry Unwin has been appointed sales manager of the National Motor Car & Vehicle Corp. at Indianapolis, succeeding James Clark who has become identified with a dealership organization. Unwin has been connected with the industry since 1901. He participated in laying out the route for the New York-to-Pittsburgh automobile endurance contest in 1903. During the war, when he held a commission as major in the Army, he superintended the construction of artillery tractors for war purposes at the Reo and Maxwell plants. He was the first secretary of the National Association of Automobile Manufacturers, later merged into the National Automobile Chamber of Commerce. Unwin has been connected with the Chicago branch of the Reo Motor Car Co. and before that was associated with agencies in New York for the Chalmers, Pierce-Arrow and the White.

Elgin Appoints K. T. Leech

K. T. Leech of Dallas, for a number of years engaged in the automobile business, both in wholesale and retail work, has been appointed a district sales supervisor for Earl Motors, Inc., his territory covering Oklahoma, Louisiana and Texas. About six months ago Leech retired from the business with which he had been associated for ten years and went to Germany to enter a new field of endeavor.

Sanders Will Retire

Frank H. Sanders, for eight years dealer in Franklin cars in the Chicago district, will sell out the business he has operated under the name of the Franklin Motor Car Co. and retire from the retail automobile field. When Sanders went to Chicago from Cincinnati the yearly business at the former dealership totaled 61 cars. In 1921 Chicago led the entire list of Franklin dealerships.

Davies Directs Service Work

R. G. Davies has been appointed field service director for the Ruggles Motor Truck Co., Ottawa, Ont., his territory including Ontario and Quebec. His duties will bring him into touch constantly with Ruggles truck owners, and by keeping the owners satisfied with the service rendered, it is expected that he will prove of material aid to the selling end of the business.

Morgana Joins Maxwell

Charles Morgana has tendered his resignation as vice-president and director of C. H. Wills & Co. to become superintendent of the Maxwell Motor Corp's Detroit plants. Morgana was with Wills and J. R. Lee in the Ford organization, and resigned with them to enter the Wills enterprise at Marysville.

ACTIVITIES OF EXECUTIVES

I. B. Derbyshire will succeed Harry Barrett as assistant treasurer of the Detroit Pressed Steel Co. in the near future, Barrett having tendered his resignation to enter the radiophone manufacturing field with a company which he is now organizing.

Captain William Sparks, president of the Sparks-Withington Co., is analyzing conditions in the Southern market for a few weeks, during which time he will make his headquarters at Daytona, Fla.

A. C. Andrews, vice-president of the Chase National Bank, has been elected a member of the executive committee of the American La France Fire Engine Co.

W. J. Rennick has been appointed secretary and treasurer of the McKone Tire & Rubber Co. at Millersburg, Ohio.

He was a specialist with Ford in the machine tool and engineering department, entering that company when it annexed the John R. Keim mills, Buffalo, in 1910.

Leahy, Durant Sales Manager

M. B. Leahy has been appointed general sales manager of passenger cars for all the Durant companies. He will be in charge of sales for the Long Island City, Lansing and Toronto plants. Leahy's first important position in the automotive industry was as New York branch manager for the Chevrolet Motor Co. He was promoted steadily until he became assistant general sales manager of Chevrolet under W. C. Sills. In this capacity he was in charge of sixty retail stores. When the Durant Motor Car Co. of New York was formed by W. C. Durant, he engaged Leahy as sales manager of that company and his promotion to general sales manager has followed in little more than a year.

Pfeffer in Engineering Company

Clarence A. Pfeffer, who was formerly president of the Saxon Motor Car Co., has formed a consulting engineering company under the corporate name of C. A. Pfeffer & Associates, which will specialize in financial problems within the industry. New York and Chicago men will be affiliated with Pfeffer in the new company, which will have offices in the Penobscot building, Detroit, and branch offices in New York and Chicago.

Mosher Leaves Covert

F. E. Mosher has resigned as vice-president and treasurer of the Covert Gear Co. of Lockport to become associated with the Dauch Chemical Co. of Louisville. Mosher is widely known in the industry, having been with the Covert Gear Co. for several years. His resignation is effective April 1.

Charles S. Turner Joins Hupp

Charles S. Turner, formerly of the Robertson-Cole Co., New York, has joined the Hupp Motor Car Co., as Far Eastern representative and is now preparing for a trip through this territory, which will take about 18 months' time. While with Robertson-Cole, Turner handled the Cole export interests in this field and is familiar with the business possibilities. There is much constructive work to be done by American manufacturers throughout the Far East before business can be restored to its former strength, Turner says. With the exception of India, he states, most of the countries are approaching a prosperous era and should present a good automobile market.

Vail Leaves Waltham Watch

E. L. Vail has resigned as sales manager of the automobile equipment division of the Waltham Watch Co., effective April 18. He has been connected in the automotive equipment field, where he is widely known, for many years. Prior to his activities in developing the market for Waltham clocks and speedometers, he was New England representative for the Splitdorf Electrical Co. and later served as sales manager for the Hoffecker speedometer.

Hardy and Peasley on Tour

A. B. C. Hardy, president of Olds Motor Works, and Guy H. Peasley, sales manager, have been making a tour of the middle and far west, visiting distributors in those sections. They report that both dealers and distributors are unusually optimistic and that prospects for immediate and spring business are beyond their expectations. The distributor at Los Angeles, they report, has sent in an order for 250 cars and says he will need 400 more for March.

Allen Made Branch Manager

W. C. Allen, former manager of the Black & Decker Philadelphia branch and subsequently special representative, has been made branch manager of the company's Chicago territory. Allen has been a jobber's salesman, was connected with the Manley Manufacturing Co. as assistant sales manager and has been associated with the Black & Decker Manufacturing Co. for about three years.

New Overland Plan Has Willys' Favor

Replaces Bank Proposal—Stockholders Will Be Asked for Their Approval

(*Continued from page* 682)

fected arrangements with its own banks whereby the latter are to take $16,500,000 in 7 per cent bonds maturing Dec. 1, 1923. These bonds are secured by fixed assets of the company in such a way that the current assets will be available for the normal operation of its expanding business.

All bank loans will be returned by these bonds, and inasmuch as the current liabilities of the company outside of bank loans are quite small in proportion to current assets the company will be left in a position to take care of operations at full capacity when conditions in the automobile industry will get back to normal.

While this financing provides for the company's needs and will have the effect of stabilizing the business for two seasons' operations, the bonds will be so drawn that they can be retired before they are due in order to make it possible for the company to refinance itself permanently at any time if it is deemed advisable to do so.

A considerable portion of fixed assets and properties can be disposed of during the life of these bonds, so that before maturity the issue should be considerably reduced in amount, thus facilitating the problem of permanent financing when conditions in the industry are propitious.

In view of the fact that the company owns a large amount in securities and properties which are not essential to the business as now conducted, and it is believed their properties can be converted into cash during the life of these bonds, it was felt by the directors of the company that this plan offered special advantages over any plan for long term financing at this time.

Loans Recently Extended

The banks recently extended for three months the $16,500,000 loans which matured Dec. 1, but were extended to March 1.

Officers of the company are assembling data on assets unessential to the business which can be converted into cash. In this category will be several parcels of real estate in various parts of the country, some buildings and other tangible property which can be placed on the market now.

The Willys-Overland interest in the Moline Plow Co., it was asserted by officers, will not be offered for sale at the present time. These holdings amount to 82 per cent of the Moline common stock.

Has $8,000,000 Cash

Willys-Overland has $8,000,000 in cash and it is believed no difficulty will be experienced in taking up a considerable portion of the bond issue before it matures. Retail sales which have been very good for several months, are reported to have been even better since the latest price reduction.

Leroy Peed, assistant sales manager, states that the Toledo branch will break its monthly record this month with the sale of more than 500 cars. Sales are excellent throughout the Central and Eastern States.

COMMERCE ADDING RADIOPHONE TO LINE

DETROIT, March 21—The Commerce Radiophone Co. has been formed as a subsidiary of the Commerce Motor Car Co. by Walter E. Parker, president, and other officers of the company. Production and deliveries have been started already.

The development of the radiophone as an auxiliary to automotive manufacture is regarded as one which may be taken up by other companies as a means of utilizing some of the present unoccupied factory space. The General Motors Corp. anticipates that some of the factory buildings it is offering for sale will be taken over by radiophone companies.

Quarter Will Meet Early Predictions

(*Continued from page* 682)

sory end of the industry are exceedingly gratifying. Releases and new orders have been received in such large volume that many plants are approaching capacity production. Business booked ahead indicates that this condition will prevail for another two months at least.

Truck sales promise to expand steadily as the year progresses. This will be true particularly of light delivery wagons as the result of the unexpectedly early improvement of conditions in the agricultural districts.

Tire production also is increasing and there are reports from Akron of a prospective price increase in the near future. Even if there is no upward revision it is assured that there will be no further tire price reductions. Increasing cost of materials has counterbalanced the greater efficiency of labor and reduced operating expenses.

From a financial viewpoint, the annual reports of large companies in the industry demonstrate that all of them have taken their losses and are going ahead this year on a profit making basis in spite of keen competition.

AMERICAN-EGYPTIAN TRADE

LONDON, March 8 (*by mail*)—Official statistics show that Egypt imported 926 motor vehicles in 1921, valued at £471,563. More than 30 per cent of these came from the United States. Italy and France sent 25 and 20 per cent, respectively. During the same period gasoline to the value of £1,389,181 was imported, chiefly from the United States, Rumania and Persia.

Court's Views Sought In Association Case

Hardwood Counsel to Make Petition—Hoover Calls Conference for April 12

WASHINGTON, March 22—A motion for a rehearing or modification of the United States Supreme Court's decree in the American Hardwood case will be made by L. C. Boyle, general counsel, this week. He will petition the court to state more definitely whether its judgment in the so-called open-competition case means absolute prohibition or inhibition on gathering industrial statistics and the distribution of these data to memberships of various trade organizations.

The court will also be requested to determine whether such activity is prohibitive only when used in connection with other factors of the trade association work which reflect agreement or understanding to fixed prices or curtailed production. The outcome of the Supreme Court action in this matter will be of utmost importance to all lines of industry.

The trade associations are manifestly uncertain as to methods of procedure in view of the Hardwood decision. Secretary of Commerce Hoover is cognizant of the situation, and as a consequence has called a meeting of various trade bodies in this city on April 12 for the purpose of discussing trade association work and devising lines of operation in accordance with the views of the Department of Justice and the Department of Commerce.

Boyle is of the opinion that the Court acted on an important statement of facts by the Government, and if a rehearing is granted he will endeavor to show that industry needs a more definite statement as to the line of cleavage in association work.

Motor Transportation Gains in Syria; Market Is Dull

WASHINGTON, March 22—Motor truck transportation has developed considerably of late in Syria, but at the present time the market is overstocked and business is depressed, according to reports received by the Automotive Division of the Department of Commerce.

Consul Knabenshire, at Beirut, reports that motor trucks, especially those with a capacity of 2 and 3-tons, have proved effective competitors to wheel carts and railways for transportation of both passengers and merchandise. With 250 trucks in operation in the Damascus district, business is improving.

The railway company there has met motor truck competition by the establishment of an automobile transportation service between Beirut and Damascus, a route of 69 miles; Beirut and Didon, 29 miles, and Beirut and Tripoli, 56 miles. The motor vehicles have been ordered from France.

Maxwell-Chalmers Report Is Presented

Balance Sheet Shows $19,731,000 Current Assets—Current Liabilities $6,278,000

DETROIT, March 21—The consolidated balance sheet of Maxwell Motor Corp. and Chalmers Motor Corp. and their subsidiaries as of Dec. 31, 1921, shows a total of $62,794,256 assets and liabilities. Total current assets are placed at $19,731,658 and current liabilities at $6,278,943.

Current assets show cash of $2,895,284; bank acceptances, marketable securities, etc., $4,121,385; car shipments against B/L drafts, $871,678; notes receivable, $528,892; customers and dealers accounts, $606,069; claims against the United States government, $144,453; and inventories, at lowest cost, $10,563,895.

Current liabilities are notes payable due June 1, 1922, amounting to $3,849,795; accounts payable, $1,841,309; accrued interest, taxes, etc., $334,141; dealers' and distributors' deposits, $253,697.

Permanent assets, shown as land, buildings, machinery and equipment, less depreciation, aggregate $16,677,590. Other assets are listed at $982,977. This latter item includes $518,603, due from Maxwell Motors, Ltd., London. Good will is carried at $25,030,296.

Gold notes of Maxwell Motor Corp. due June 1, 1923 and 1924, total $8,172,171. Gold notes of Chalmers due Oct. 1, 1922, aggregate $3,150,000; reserves for exchange, discounts, contingencies and for sales refunds, $613,144. Capital stock totals $44,579,996. This represents $21,463 minority stockholders' interest in Chalmers; $15,186,800, class A Maxwell and $29,371,733, class B Maxwell.

Chalmers' Balance Sheet

The consolidated balance sheet of Chalmers Motor Corp. and subsidiaries shows total assets and liabilities of $8,655,764. Current assets total $3,420,529 and current liabilities, $409,033. The assets include cash on hand, $741,517; car shipments, $36,997; bank acceptances, $11,508; notes receivable, $87,097; customer and dealer accounts, $165,927, and inventories at lowest cost or market value, $2,377,482.

Current liabilities are accounts payable, $257,836; mortgages and land contracts, $15,424; accrued interest and taxes, $61,528; dealers' and distributors' deposits, $74,244.

Permanent assets total $4,950,811. Other assets, $55,421; deferred assets, $229,001. A claim against Maxwell Motor Co., Inc., is listed at $1, pending determination of validity and amount.

Other liabilities are listed as: acquired by purchase of assets of Maxwell Motor Co., Inc., June 1, 1921, $4,163,694; credits subsequent to June 1, 1921, $196,739. First mortgage gold notes as shown in Maxwell consolidated statement, are $3,150,000. Reserves total $315,962. The amount of capital stock outstanding is 43,986 shares of preferred and 399,348 shares of common. A foot note declares the company "obligations for materials undelivered on Dec. 31, approximated $1,000,000."

The attention of stockholders is directed by President William Robert Wilson to the substantial balances of cash and cash securities and the ratio of current assets to liabilities. He notes a further reduction of approximately $6,000,000 in inventory since the last report.

"The corporation's new product, after a phenomenal reception, is finding an increasing acceptance and a more extensive dealer distribution," Wilson asserts. "Its quality and appearance have apparently marked it out among automobile buyers as an outstanding value, and your management has confidence that your corporations will enjoy during the coming year their share in the increased volume of business anticipated.

Receivers Are Appointed for Ward La France Truck

ELMIRA, N. Y., March 22—Oscar N. Reynolds and Alexander S. Diven of this city have been named receivers for the Ward LaFrance Truck Co. by Federal Judge John R. Hazel of Buffalo. Application for receivership was made by Leslie L. Zeet of Pittsburgh. The action will keep intact assets of the company, it is said, until bills can be paid.

The company claims assets of $280,000 and liabilities of $180,000. The business is being continued, and the receivers say that prospects for paying off all indebtedness are favorable.

Before the receivers were named, A. Ward LaFrance, president and general manager of the company, notified creditors that financial affairs of the company had reached a crisis and that some of the note holders had asked for the appointment of a receiver. He expressed the hope that someone would be able to come forward with a satisfactory reorganization plan.

NEW WACHUSETT TRUCK

FITCHBURG, MASS., March 18—The Wachusett 2½-ton truck, assembled from standard units for the New England market is a newcomer in the commercial field. The parts used include such names as Continental, Timken and Brown-Lipe. Officers of the Wachusett Motors, Inc., the assembler, are F. S. Suthergreen, president; W. C. Dresser, vice-president; F. H. Brown, treasurer, and R. H. Bingham, secretary.

ALLEN SALE DATES FIXED

COLUMBUS, March 17—Judge Sater in the Federal court has set April 18 for the sale at public auction of the assets of the Allen Motor Co. The property consists of plants at Columbus and Bucyrus and much material as well as some finished automobiles. The minimum upset price is fixed at $500,000.

Negotiating to Buy Torbensen Axle Co.

Cleveland Interests are Seeking Controlling Interest in Stock Republic Holds

CLEVELAND, March 22—R. C. Enos, vice-president and general manager of the Torbensen Axle Co. stated to-day that Cleveland interests are negotiating for the company, and it is expected that purchase of the plant will be closed late this week.

The Republic Motor Truck Co. has owned all the $750,000 common stock of the company since 1917, and the Cleveland interests propose to buy a controlling interest in this stock. It is understood that if the reorganization is effected there will be some new financing that will greatly strengthen the position of the axle company.

Enos denied a report that J. O. Eaton, formerly president of the Standard Parts Co. and later one of the receivers for that company, had been selected as president of the Torbensen company.

The $2,500,000 funded debt of the Republic Truck Co. is secured by a first mortgage on all the fixed assets of the company and by pledge of the entire common stock of the Torbensen Axle Co. This fact has complicated somewhat the negotiations for purchase.

The Torbensen company was incorporated in Ohio in 1916 as a successor to the Torbensen Gear & Axle Co. It also controls the Powrlok Co., which manufactures differentials in Cleveland. The Torbensen plant here has an annual capacity of from 40,000 to 50,000 sets of axles.

Autocar Business Gains 25 Per Cent This Year

ARDMORE, PA., March 21—The Autocar Co.'s main factory here, has increased its working time three hours, to fifty hours a week, because of increased business. This brings additional returns to 1250 employees. One thousand other employees in branches also are working on the same basis.

David Ludlum, president of the company, states that business so far this year has increased 25 per cent. Activity in highway construction and building are reflected in orders for trucks.

MONOGRAPH ON CHINA READY

WASHINGTON, March 22 — Announcement was made at the Automotive Division, Bureau of Foreign and Domestic Commerce, that a monograph entitled "China; Automotive Conditions and the Good Roads Movement," by J. Morgan Clements, American Trade Commissioner, has been prepared and is ready for distribution to the trade upon application. It is pointed out that the increase in road-building in China is not sufficient to warrant heavy sales of motor cars and trucks in that country.

Illinois Will Test Experimental Road

Results in California Show Roads Laid by Commission There Are Failures

WASHINGTON, March 22 — Final tests on an experimental road that has been built at Bates, Ill., by the Illinois Division of Highways with the co-operation of the Bureau of Public Roads, will be started on March 27. The road is two miles long and includes 63 different sections, representing as many different methods and kind of construction with various thicknesses of concrete, cement grout and asphalt filled brick, as well as asphaltic concretes and concrete filled with rolled stone bases.

Since the completion of the construction of the road in April of last year, a corps of engineers has been kept engaged making observations for the effect of temperature changes, static and repeated loads and subgrade conditions, thus collecting data which, when analyzed, will supplement the information necessary for the rational design of roads.

In the final tests a fleet of ten motor trucks, surplus material from the war department, will be driven over the pavement, loaded lightly at first, but increasing in weight as the tests progress until a maximum of 12,000 pound rear wheel load is reached. The results will show definitely the types of pavement which can be expected to support heavy traffic, as well as those which will not satisfy the heavy traffic requirements that may be expected in the next ten or twenty years.

Results in California

SAN FRANCISCO, March 18—The concrete highway test conducted at Pittsburg, Cal., has developed the following results, according to the California State Automobile Association:

The five-inch reinforced concrete slabs now being laid by the California Highway Commission were the first to disintegrate and fail during the test.

The steel reinforcement method does not appear to be of sufficient value to pay for the additional cost required. It appears clearly that on equal foundations thickness of slab is the only insurance of permanency.

Section "J", the Arizona section, showed but little evidence of failure. This section is the six-inch plain concrete section and most nearly approximates the recommendations made by the association in its recent investigation of the state highway system as the minimum thickness and type of pavement that should now be laid on main trunk lines by the state highway commission.

Between Nov. 9 of last year and the close of January of this year, marking the beginning and end of the test, the amount of traffic driven over the highway reached a total of 3,668,100, figured as equivalent to traffic for ten years on the ordinary state roads. Each of the thirteen different types of concrete roadway was subjected to the same test and, except for the design of the pavement itself, under identical conditions. Of these thirteen sections, but three, two of the California Highway Commission which proved failures and the one known as the "Arizona standard" are in general use in the western part of the United States.

Four Models of Stoughton Truck Reduced in Price

STOUGHTON, WIS., March 20—The Stoughton Wagon Co. has made reductions ranging from $205 to $450 in the price of the chassis of the Stoughton truck. The new schedule follows:

	Old Price	New Price
Model F, 1-ton	$1,995	$1,790
Model B, 1½-ton	2,350	2,150
Model D, 2-ton	2,800	2,490
Model E, 3-ton	3,600	3,150

The price of the C Model ¾-ton remains unchanged at $1,240. No list has been issued on bodies which the Stoughton company manufactures to order in any type and size desired by customers, according to specifications.

WICHITA TRUCKS LOWER

WICHITA FALLS, TEXAS, March 17—The Wichita Motors Co. has made a downward revision in the prices of its trucks as follows:

	Old Price	New Price
Model K—1-ton	$2,000	$1,875
Model M—2-ton	2,500	2,400
Model RX 3-ton	3,500	3,200
Model O—4-ton	3,900	3,500

Ogren Price Reductions Range from $500 to $700

MILWAUKEE, March 22—The Ogren Motor Car Co. announces price reductions ranging from $500 to $700. The list follows:

	Old Price	New Price
7-pass. Phaeton	$4,350	$3,850
4-pass. Roadster	4,250	3,750
5-pass. Sport Phaeton	4,250	3,750
4-pass. Sport Roadster	4,250	3,750
7-pass. Sport Phaeton	4,350	3,850
4-pass. Coupe	5,200	4,500
7-pass. Sedan	5,500	4,800

YUBA TRACTOR REDUCED

SAN FRANCISCO, March 20—The Yuba Products Co. has announced reductions in the prices of its various models of tractors. The old and new prices are:

	Old Price	New Price
Model 12-20	$2,600	$2,400
Model 15-25	3,100	2,750
Model 25-40	4,650	4,250
Rodebilder, Yuba engine	5,000	4,750
Rodebilder, Wisconsin engine	5,000	4,600
Model 20-35 oversize	4,185	3,900

FEDERAL CORP. ASSETS SOLD

BOSTON, March 22—The Liberty Spark Plug Corp. has purchased the assets of the Federal Corporation of Westfield, Mass., and also the patent rights and trade mark to manufacture and sell Liberty spark plugs.

Majority Creditors Accept Premier Plan

Refinancing Will Bring in $500,000 New Money—Has Backing of Bank

INDIANAPOLIS, March 23—Plans for the reorganization of the Premier Motor Corp. have been practically completed, but a detailed statement is withheld pending final decision regarding the management and additional directors. The plan has been accepted by 90 per cent of all creditors, including 75 per cent of the merchandising creditors.

The refinancing, it is understood, will bring in about $500,000 in new money. It is reported that the plan has the backing of the Fletcher-American National Bank and the administrator of the estate of the late L. S. Skelton.

The reorganization plan is conditioned upon the transfer of all assets of the Premier Motor Corp. of Delaware to the Premier Motor Corp., which would be organized under the laws of Indiana with a capital of $1,000,000 divided equally into preferred and common shares. The new capital which would be brought in would be sufficient to complete the present production schedule, thereby liquidating enough of the inventory to provide for the ultimate payment of merchandise obligations.

Automotive Equipment Makers Discuss Exports

CHICAGO, March 22—Following a luncheon given by the Association of Automotive Equipment Manufacturers to hear Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce, it was announced that the association would take up the appointment of an export committee at its regular meeting on March 24 to cooperate with the Department of Commerce.

It developed during the luncheon and the discussion that attended Lee's remarks on the work of the bureau that several members of the association have had some rather troublesome experiences with export orders. These members did not know before the meeting how to obtain the information that the department is now ordering for them.

Previous to coming here, Lee visited St. Louis, addressing the Advertising Club there and conferring with executives of the automotive industry in that city.

FORM NEW TRUCK COMPANY

KENOSHA, WIS., March 23—William Martinson, formerly first vice-president of the Winther Motor Truck Co., and Charles T. Abbott, who formerly was secretary of the same company, have formed a new corporation to be known as Martinson Motors, Inc., to manufacture motor trucks. The capital of the new company is $2,250,000.

Arkansas Bankers Discourage Buying

Regardless of Their Attitude, However, Sales Have Shown Steady Increase

LITTLE ROCK, March 18.—Arkansas bankers continue their strangle hold on the automobile business of the state and apparently it will take something stronger than a change of heart to loosen the purse strings of the strong boxes. There is plenty of money in the banks for almost any kind of a loan, with the one exception of motor cars and every possible discouragement is being placed in the path of the prospective purchaser of an automobile.

Automobile dealers are loaded down with prospective buyers—people who really want motor cars and while sales have increased since the first of the year, there is plenty of room for improvement before the industry gets back to anything like normal. Without the aid of banks, however, it is noted that sales have been showing a steady increase for several months.

Another element, also, has entered into the sale of new automobiles and that is the man with a car to trade in. He usually wants twice what the car will bring in the market and when shown what cars similar to his are bringing he invariably insists that those are old cars, while his is in good condition.

Little Rock dealers have tightened up on trading to a point where it is practically impossible for a buyer to get a high price for his old car. The dealers know what cars are selling for and govern their trades accordingly.

Ministry Decides to Sell British Airship Fleet

LONDON, March 7—(By Mail)—The British Air Ministry has decided to hand over at once its fleet of airships to the Disposals Board, despite the announcement made last month at the air conference that a period extending up to June next would be allowed for an imperial air service to be organized with these airships as the nucleus of a fleet.

The plan for the formation of such a service has failed, for although the governments of India, Australia, South Africa and New Zealand were invited to co-operate, only Australia assented. On this account and for reasons of economy, the reprieve of the airships has been cancelled.

The airships in question are: R80, R33, R36, R37 (incomplete) and the ex-German Zeppelin L71; R36 is the only one fitted with a passenger car. In addition to the vessels themselves, there are stations, engines, fabric, gas bags, station equipment, spare parts and stores to be disposed of.

The Disposal Board will be free to decide how and when they shall handle the airships; they may hold them for awhile in the hope that even now a corporation may be formed to fly them, or they may scrap the entire fleet and sell the material piecemeal. Alternatively they may sell them to a foreign power, and in this connection it is reported that an emissary is on his way from the United States with the object of securing R33 or R36 for that country.

Business in Britain Is Feebly Fluctuating

LONDON, March 10 (*by mail*)—"Slow" and "Stop" are the prevailing speeds in the British motor industry. Demand for small cars and motorcycles is dead steady, while that for the large car is dead. Small orders have been obtained from Australia, Brazil and South Africa. Owing to stagnation, manufacturers find it difficult to retain skilled workers, and in some cases the latter are being paid for doing nothing in order to prevent them obtaining employment elsewhere.

It is thought that potential buyers are waiting for the present quarter to elapse in order to evade taxation. Company reconstruction is in the air, but is being deferred because conditions do not appear to justify fresh issues. Sir William Letts of Crossleys and other motor concerns, who has just returned from America, thinks it will be eighteen months before trade revives.

DORT PRODUCTION GAINING

DETROIT, March 20—Dort production in 1922 is showing steady gains as the season progresses, according to an analysis of sales by President J. Dallas Dort. January tripled the output of the same month in 1921, and February more than doubled January. Orders for March delivery will exceed February by more than 200 per cent, he says.

1400 "INDIANS" BY APRIL 1

BOSTON, March 22—According to a director of the Hendee Manufacturing Co. orders have been issued to speed up operations at the plant so that a production of 1400 motorcycles can be reached in April. The company soon will announce a new selling policy whereby machines may be paid for on installments.

MACK MAKERS CHANGE NAME

NEW YORK, March 22—Stockholders of the International Motor Truck Co. at their annual meeting here to-day decided to change the name of the company to Mack Trucks, Inc. All the directors of the company were re-elected. No other business was transacted.

W. E. MC CREA DEAD

ROCK ISLAND, ILL.—W. E. McCrea, for 20 years general manager of the Moline Wagon Works and vice-president and sales manager of the plant after it was taken over by Deere & Co., died at his home in South Pasadena. He had resided the last nine years with a sister there. He was 63 years old.

Banks Favor Trucks But Deprecate Cars

Speaker at Credit Meeting Says Financing "Pleasure" Vehicles Is Poor Business

CHICAGO, March 17—The Central Automobile Credit Association at its meeting here listened to an address by Charles W. Folds of Hathaway, Smith, Folds & Co.

Folds spoke on the necessity of presenting to the bankers a more convincing argument for financing automobile sales. He said that there was a wide spread conviction on the part of the bankers that the financing of automobile purchases was a more or less hazardous business and that furthermore the operation of the financing companies had a tendency to encourage extravagance and was contrary to the thrift ideas which the bankers were so anxious to establish in the minds of the public.

Cites New York Banker

The speaker said that he recently addressed the Robert Morris Association at Indianapolis, and one of the speakers on that occasion was an official of the National City Bank of New York. This banker was asked if the business of financing automobiles was a good business and he replied that the financing of trucks might be considered good but the financing of "pleasure" cars could not be considered good banking.

This remark created some amusement on the part of the diners, but a guest, a banker of Argo, Ill., asked permission to be heard and he expressed very frankly the opinion of the New York banker. He said that it was the purpose of bankers to inculcate ideas of thrift to be manifested in savings bank deposits. He asserted that the financing companies were encouraging extravagance by financing purchases of cars for men who could not afford either to buy or to maintain them after they were bought. He admitted the validity of utility sales but said exactly the same thing which the speaker referred to at Indianapolis emphasized, namely, that his bank would encourage the purchase of a motor truck or a tractor while at the same time deprecating the purchase of an automobile.

Speaker Not Convinced

Much of the rest of the meeting was devoted to members of the association trying to convince this banker that the purchase of an automobile was really promoting habits of thrift on the part of the car purchaser, and that the use of the automobile for recreation and business was well worth the money that was invested in it. However, they made very little progress and those present regarded Franklin's opinion as indicative of the tendency of a good many bankers.

Folds called attention to the fact that because of an arbitrary ruling at Washington the paper of the automobile financing companies is not regarded as discountable at Federal reserve banks.

FINANCIAL NOTES

Eisemann Magneto Corp. reports net sales for the year ended Dec. 31, 1921, of $646,775 and a gross manufacturing profit of $84,758. The total income was $87,516, the net loss $201,635 and deficit after dividends $175,380. Unfilled orders as of Jan. 1, 1922, eliminating doubtful accounts, were 42,968 magnetos for 68 customers, approximating $1,500,000 in value. A new line of production is in process of development. The comparative balance sheet shows cash on hand Dec. 31, 1921, of $39,086, as against $298,530 at the commencement of operations on June 30, 1919; accounts receivable, $190,316, compared with $391,212 on the latter date and inventory of $1,879,698 Dec. 31, 1921, contrasted with $1,140,730 in 1919. The notes payable aggregated $300,000 at the conclusion of last year's trading, compared with nothing on the 1919 date, and accounts payable in 1921 of $65,960, as against $22,024 June 30, 1919.

J. I. Case Threshing Machine Co. ended the year 1921 in a strong position despite the adversities with which it had to contend in its line of industry. The net result of operations was a loss of $583,431 but this was due in large part to an inventory adjustment which caused a loss of $2,788,458. The company had a comfortable working capital at the close of the year although cash on hand had shrunk considerably. Total current assets amounted to $21,411,013, against which stood current liabilities of $6,456,221, leaving a working capital of $14,954,786. Current assets amounted to about three and a third times current liabilities. The total surplus was reduced by the year's loss of $583,431, $910,000 preferred dividends and a special contingent reserve of $700,000, leaving as of Dec. 31, 1921, a surplus of $1,622,491.

Packard Motor Car Co. reports that there are 3844 holders of preferred stock of the company and 1698 holders of the common stock. The outstanding shares of preferred stock total 147,818 and those of common stock 1,888,314. The widening of distribution of ownership is indicated by the fact that nearly 56 per cent of the preferred stock is in the hands of small holders, those owning less than 100 shares. These investors number 3658 or about 95 per cent of the total number of preferred stockholders. Only 13 per cent of the outstanding shares of this class is held by owners, or more than 1000 shares each. The highest amount in the hands of any individual is 3215 shares, or about 2 per cent. Out of the 1698 holders of common stock 1333, or about 78 per cent, own less than 100 shares each.

Chandler Motor Car Co. since Jan. 1, 1922, paid off all current trade obligations as of Dec. 31, $420,000 dividends payable Jan. 1 and had reduced bank loans $500,000, or 40 per cent. Based on this, 57 per cent of current liabilities at the beginning of the year had been met in the last two and one-half months. January and February shipments are reported to be 1600 cars, compared with 692 in 1921. The company expects to approach 2000 car shipments in March and to maintain this rate throughout the second quarter.

Martin-Parry Corp. reports for 1921 net income, after charges, inventory, adjustments and Federal taxes, of $820, against a net income of $311,345, or $3.11 a share earned on the 100,000 shares of its no par capital stock in 1920. After payment of dividends there was a deficit of $200,820 against a surplus of $111,354 in 1920. The company's cash, according to the balance sheet, was $98,732, in contrast to $98,422 in 1920, and its accounts receivable were $174,454, against $133,509, while the notes receivable were $48,455 in contrast to $38,992. Accounts payable increased from $74,962 to $114,099. The company borrowed $150,000 on notes.

Wright Aeronautical Corp. for the year ended Dec. 31, 1921, reports net income, after charges and Federal taxes, of $597,555, equivalent to $2.66 a share earned on the 224,390 shares of no par value common stock. This compares with net profits of $411,349, or $1.83 a share, in the previous year. The net sales in 1921 were $2,426,187 compared with $1,486,124 in 1920. The operating income was $458,488 in the year first mentioned and $140,116 in the last named year. The surplus at the close of the year's business in 1921 was $485,360 against $411,349 in 1920.

Carlisle Tire Corp. announces that it is offering $200,000 in notes exclusively to stockholders. They are payable one year from April 1 next with 8 per cent interest, payable semi-annually. The proceeds of the notes will be devoted to increased operations and material investments. The company contends that it is the part of wisdom to buy materials at this time, when the market prices are low.

General Motors Corp. directors will meet next week to take action on dividends. Payments will be ordered on the preferred and debenture stock, but the common will again be passed.

Lansing Plant Surveyed for "Star" Possibilities

DETROIT, March 22—Complete details of the equipment at the Durant Lansing plant have been forwarded to Durant engineers in New York by Carroll Downs, vice-president of the Durant Michigan Co., with a view to ascertaining the possibilities of the plant for the manufacture of the new Star car in large quantities.

According to statements accredited to Downs in Lansing, the plant probably will supply the territory between the Alleghanies and the Rockies with the Star and will get into limited production by June 1. By the end of the year it is expected to reach a 200 a day schedule.

Downs was in Lansing accompanied by Edward Ver Linden, general manager of the plant, and M. B. Leahy, general sales manager for the Durant organization.

Contracts for the supply of units for the new car are practically signed, according to one of the leading unit makers, and will be official within a short time. Preparations for the manufacture of the parts are in most cases complete, and as soon as the Durant factories are ready to receive them, deliveries will begin.

Dealers from All Sections Wish to Handle New "Star"

NEW YORK, March 22—Several hundred applications from dealers in every section of the country to handle the new Star car have been received at the headquarters here of Durant Motors, Inc.

Detailed plans for the distribution of the Star have not been worked out, however, and no appointments will be made until that has been done. While no announcement has been made, it is understood that some new sales plan is likely to be adopted for the sale of the car which is designed to compete with Ford.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Call loan rates displayed an easier tendency last week and quotations ranged from 3 per cent to 4 per cent as compared with 3½ per cent to 5 per cent in the previous week. This is the lowest range since early in January, and it is doubtless due, in the main, to the accumulation of funds resulting from comparative inactivity in several lines of business.

Fixed date funds also showed signs of ease and toward the last of the week 60 and 90 day maturities were quoted at 4½ per cent, and four, five and six months' loans at 4½ per cent to 4¾ per cent as compared with a previous range of 4¾ per cent to 5 per cent for all maturities. The prime commercial paper rate remained unchanged at 4¾ per cent.

The Federal Reserve statement as of March 15, 1922, showed an increase of $10,149,000 in gold reserves and $7,437,000 in total reserves. Total bills on hand declined $53,931,000, while total earning assets increased $100,595,000. Total deposits increased $133,408,000, while Federal Reserve notes in circulation showed a decline of $8,841,000. The Federal Reserve ratio declined from 77.8 per cent to 75.6 per cent.

The statement of the New York institution showed the following decreases: $35,027,000 in total reserves; $9,884,000 in total bills on hand; $100,753,000 in total earning assets. Deposits, on the other hand, increased $74,019,000, while Federal Reserve notes in circulation declined $1,779,000. The ratio of total reserves to deposit and Federal Reserve note liabilities combined decreased from 84.9 per cent to 78 per cent.

Last week the Federal Reserve Bank of Atlanta reduced its discount rate on all classes of paper from 5 per cent to 4½ per cent.

The Bureau of Labor Statistics index number for February showed a gain of more than 2 per cent in wholesale commodity prices, as compared with a recession of 7/10 of 1 per cent for January. The February gain marks the sharpest advance for any month since last August. The general price level now stands 51 per cent above the 1913 average, although it is 44.5 per cent below the peak reached in the spring of 1920.

The Treasury Department's recent offering of $250,000,000 1-year 4¼ per cent Certificates of Indebtedness dated March 15 was heavily oversubscribed.

G. M. DEALERS ORGANIZE

DETROIT, March 17—The General Motors Dealers Association has been formed in Milwaukee by dealers handling lines produced by General Motors units as a means of furthering their mutual interests and the interests of the corporation. The plan has met with the approval of company executives, and similar organizations in other cities are expected to follow the Milwaukee initiative.

INDUSTRIAL NOTES

Air Reduction Co. has purchased all assets, including patents and trade marks, of Davis-Bournonville Co., pioneer manufacturer of all lines of oxy-acetylene apparatus. The manufacturing and sales organizations of the latter company will be amalgamated with those of the Air Reduction Sales Co., which is the operating company for the Air Reduction Co. This will further enlarge the company's extensive business in oxygen, acetylene, carbide and all products used in the oxy-acetylene industry. The purchase was accomplished without public financing or bank loans.

General Spark Plug Co., St. Louis, has been incorporated for $120,000, fully paid up, and expects to be in production in thirty days. T. W. Meloan is president of the company, B. C. Howard vice-president, W. H. Grant secretary and treasurer. These officers compose the directorate, together with E. J. Newton of Cleveland and Wells S. Murphy of Kendallville, Ind. J. M. McKernan is production manager.

Martin-Parry Corp. has completed negotiations for a five-year contract with the Edward Hine Lumber Co. of Chicago for lumber for Martin-Parry bodies. The contract also calls for the erection of two plants at Lumberton, Miss., one to be used as a special cutting-up plant of the lumber company and the other to be built by Martin-Parry for the finishing and assembling of its base and top units.

Alemite Lubricator Co. of Syracuse has been purchased by W. H. Smith of that city, who will operate the business on a larger scale than heretofore. The company plans the erection of a large installation rack and will provide fifteen minutes' service. Smith has been connected with the Alemite company in Colorado, New Mexico and Wyoming.

Atlas Asbestos Co., Norristown, Pa., has been organized with J. Carroll Johnston as president to specialize in brake lining and other asbestos textiles and packings. Johnston was associated for many years with the American Asbestos Co.

Braender Rubber & Tire Co. has elected the following directors: J. K. Watson, R. Trimble, C. A. Horton, C. A. Shreffler, H. Cross, R. P. Boyd, T. Gardner, J. T. Johnson, M. Damman, W. P. Braender and F. L. Braender.

Black & Decker Manufacturing Co. has moved its Cleveland office to 2030 East Twenty-second Street. Dan Paul, formerly manager of the Pittsburgh office, is in charge.

New Jersey Die Casting Co. has been formed at Irvington, N. J., with E. H. Kelley president, and has acquired the entire assets of the Die Casting Co. of New Jersey.

Taft-Peirce Manufacturing Co. announces the removal of its Detroit office to 2230 First National Bank Building. William Fairhurst is manager of the office.

Automobile Body Builders Association is now located in the Gotham National Bank Building, New York.

BEARING BUSINESS IMPROVED

PHILADELPHIA, March 21—Roller bearing manufacturers state that for the first time in a year and a half orders are being placed for future delivery. Equipment is being improved and new machinery ordered. Business in some cases has almost doubled in the last few months and covers a wide range of products. Sales indicate that factories are preparing for increased production in the immediate future, and the present points to a good year in this district.

Reserve of Gasoline Near May, 1921, Mark

WASHINGTON, March 20—Stocks of gasoline jumped 119,000,000 gallons during January, giving a reserve of 705,700,000 gallons, according to statistics compiled by the Bureau of Mines. This reserve is 130,000,000 gallons more than for the corresponding date in 1921, and is rapidly approaching the 800,000,000 gallon peak set in May of that year. Present stocks are equivalent to a 50-day supply, based on the total daily average consumption for 1921.

The daily average production in January increased by 371,195 gallons over production for the preceding month. This, however, was about 240,000 gallons under the daily average production in January, 1921. The daily average consumption fell off in December by about 1,000,000 gallons.

Lubricating oil shows a daily average production of 2,397,000 gallons during January, this being 266,000 gallons less than the daily average for December, 1921. Stocks on hand were 245,000,000 gallons, an increase of 28,465,000 gallons over the month previous.

Advice Given Tractor Makers on African Trade

WASHINGTON, March 22—American tractor exporters are advised to obtain co-operation of merchants as a preliminary to developing interest among farmers when seeking a market in Africa. The Department of Commerce has received communications from agents in South Africa, stating that the tractor market is largely in the hands of American exporters, and this is due principally to American enterprise and sales methods.

According to British competitors, successful development of these markets depends upon the tractor deals.

Machine Tool Makers Join in Big Merger

PHILADELPHIA, March 23—Officers of the Hilles & Jones Co. of Wilmington, Del., manufacturer of machine tools, announced to-day that the leading machine tool manufacturing plants of the country had been merged under the name of the American Machine Tool Corp. The capital is to be predicated upon the size and holdings of the plants to be merged, and will run into hundreds of millions of dollars.

The companies going into the consolidation are Hilles & Jones, Betts Machine Co., Rochester, N. Y.; Colburn Machine Tool Co., Cleveland; Newton Machine Tool Works, Philadelphia; Modern Tool Co., Erie, Pa.; Carlton Machine Tool Co., Cincinnati; Lodge & Shipley Machine Tool Co., Cincinnati, and Dale Machinery Co., New York City.

METAL MARKETS

As a means of quickening orders and specifications at the old prices, the recent advance in steel bar quotations by certain of the independent interests may be said to have been fairly successful. Quite a few consumers enjoyed protection on the 1.35@1.40c. quotation, Pittsburgh base, and when the 1.50c. price was announced by one of the independents (several others later following the former's example), these consumers made haste to safeguard themselves. In some instances contracts covering requirements until June 30 were closed at 1.40c. The market, however, is no more 1.50c. today than it was when Jones & Laughlin Steel Co. announced its unwillingness to book further steel bar orders at below that level.

Some mills are asking 1.50c., but there is no limit to the tonnages that can be placed at 1.40c. and, while there is no question that quotations of 1.25c. and 1.30c., which were freely heard a month ago, have disappeared, there is considerable blank space left in the order books of some of the rolling mills, and they are more than eager to build up a comfortable backlog. So far there has been no advance in cold-finished steel bars as the result of hot-rolled prices. Where tonnages are involved makers of cold-finished bars appear to be glad to name 1.80c.

There are sufficient orders in the market to support prevailing prices for most steel products. The demand, however, is not sufficient to warrant any advance in prices. The best that producers can and do hope for is a steady market, not a rising one. In the sheet market fairly active demand for ordinary sheets continues, but there has been a decided easing off in fresh inquiries for full-finished automobile sheets. Competition has turned even keener than in the past, and there have been rumors of isolated instances of sharp cutting of prices on black sheets.

Steel.—Automotive consumers are consistent buyers of both cold- and hot-rolled strip steel, orders of 500 tons being more plentiful than in a long time. As a result, the rate of operations of strip steel mills is constantly improving. The market for hot-rolled ranges from 1.80c., Pittsburgh, upward, while cold-rolled is quoted at 3.50c. The sheet bar market is more active and the general quotation is $29, Pittsburgh or Youngstown. Bolt and nut interests report good demand from the automotive industries, with much shading of prices in evidence.

Aluminum.—Publication a few days ago of a report that the Committee of Ways and Means was ready to report the revised tariff bill in the near future has caused holders of aluminum to be more reserved. While opposed to any increase in the duty on aluminum, importers and dealers in foreign aluminum naturally will want to conserve their stocks if there is a possibility of a tariff providing much higher duties being rushed through Congress, a contingency which at least must be reckoned with. The market is steady.

Pig Iron.—Automotive foundries continue to buy conservatively, tonnages involved ranging from 50 to 500 tons. Blast furnaces still complain that market levels are below cost of production, but the probabilities are that early readjustment of freight rates on ore and of the price of that raw material itself will permit of a considerable saving in production costs.

Copper.—Some of the producers who have resumed operations are already back on a 50 per cent of normal basis. Automotive demand for copper and brass products is on the increase.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March, 1922 — Santiago, Chili, Annual Automobile Show.

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

June 20-24 — White Suplur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Good Organizations Behind Best Sellers

Interest in Chicago Is Centering on Less Than Dozen Lines

CHICAGO, March 21—The demand for cars in Chicago has centered upon less than a dozen lines. Those favored lines include all classes of cars and for them business is good. Sales are far in excess of those of a month ago, and inquiries and live prospects are in such large volume that the promise of satisfactory sales is held out indefinitely.

In these lines that are popular with the public, favor seems to have been established at the Chicago show. It is not accident that coincident with the best selling lines there should be hard working organizations behind them. Personality of the dealer, his reputation and the reputation of the products he represents, aided by price that seem exactly to fit are other features that are helping to move cars here.

There seems to be a stir in the truck market. Interest in buying is expressed but for the most part this interest has not developed many sales excepting in one line which has been selling almost up to record volume for three or four months. The reasons given for activity in this line is that the organization was kept together and always on the job and that the company was powerfully financed and thus enabled to go through months of financial drain when there were no sales.

Business prospects generally are reported much brighter than they were a year ago. That March sales will go far ahead of February there seems no doubt.

TEXAS TRADE HOLDS UP

DALLAS, March 21—There appears to be no general depression in the automobile business in Texas for the first twenty days of March. Dallas dealers declare the business held its own and the good sales conditions brought about by the annual spring show are still being felt. They say the actual sales thus far this month are about as large as those for similar periods of January and February.

FLAT RATE FOR CHEVROLET

DETROIT, March 22—The Chevrolet Motor Co. is working out, through its Detroit retail branch, a flat rate system of service which is expected to be ready for general adoption by all Chevrolet dealers by early summer. Chevrolet branches are now installing the latest features of the new Chevrolet models, such as the hand emergency brake lever, for owners of former models, at a fixed low cost.

C. L. THURSTON DIES

NEW YORK, March 22—Clarence Luther Thurston, for six years export manager of the Earl Motor Car Co., is dead at his home on Riverside Drive. He was born in Omaha in 1880 and was a son of the late Senator John M. Thurston. He was graduated from Harvard in 1900. He was secretary of the American Legation in Buenos Aires for a year. Thurston was taken ill several months ago while traveling in Spain in the interests of his company. He returned to the United States in February.

TORBENSEN PARTS STATIONS

CLEVELAND, March 23—Announcement is made by the Torbensen Axle Co. that it is establishing a chain of parts service stations throughout the country to assure users of its axles of national distribution of service parts. Each main station will carry a complete line of axle parts for all models, so that parts can be sent to any point in its territory within 24 hours.

Employment Exceeds Mark Set in December

February Shows 89,647 on Payroll in 49 Plants Against 85,524 in January

WASHINGTON, March 20—Comparison of employment in 49 identical establishments in the automobile industry for January and February, according to the Bureau of Labor Statistics, shows that the number on the payroll in February increased 4.8 per cent over the preceding month and that the percentage of wages increased 58 per cent. Statistics for February showed that in the 49 reporting establishments 89,647 were on the payroll in February, as compared with 85,524 in January. The amount of the payroll in February was $2,431,860, as against $1,539,613 in January.

Distinct Gain This Year

Comparing February 1921 and February 1922 a distinct gain is shown this year. The number on the payroll in February 1920 increased 58.4 per cent and the amount of the payroll in 48 identical establishments increased 82.5 per cent. In February 1921, 48 establishments reported 58,536 employees and last month these same firms reported 92,746 on their payrolls. The payroll for February 1922 amounted to $2,528,514, as against $1,381,052 for the same period last year.

Statistics on changes in wage rates and per capita earnings, compiled by the Department of Labor for the automobile industry are reported as follows:

A wage rate decrease of 5 per cent was reported by one establishment, affecting 12 per cent of the force. More time was worked and the per capita earnings showed an increase of 50.7 per cent when January and February figures were compared, bringing the industry back to a little above the level of December after the slack work of January.